MODERN Machine Shop

HOWARD CAMPBELL, Editor

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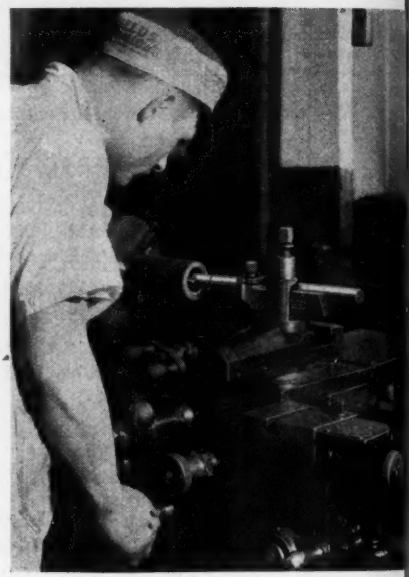

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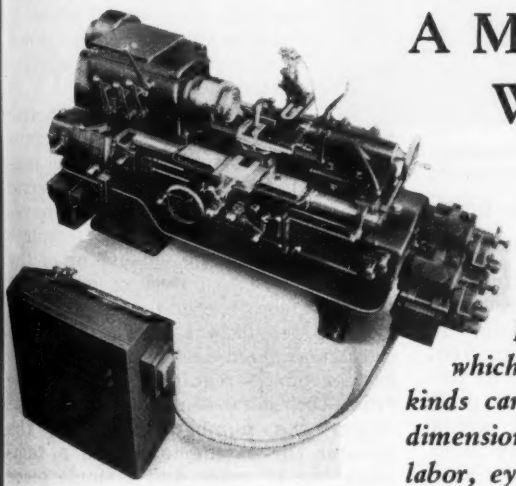
FEBRUARY, 1932

CINCINNATI, OHIO

VOL. 4, NO. 9



A Machine With An Electric "Brain"

Here is a mechanism with which irregular contours of all kinds can be machined to exact dimensions without back-breaking labor, eye-strain, and guess-work.

By PHILIP WINTER

SEEING a lathe in full operation with the tool feeding along, feeding in here and backing out there, now taking a heavy cut and then a light one—all without the touch of an operator's hand—would seem to be a weird and uncanny experience. Yet such an experience is a matter of every-day routine in a number of modern metal-working plants. There is nothing supernatural about it, however; the lathe is a Monarch Helical-Geared Timkenized Lathe, equipped with Keller Automatic Electric Controls. The machine is manufactured by the Monarch Machine Tool Company, Sidney, Ohio.

Since this machine was announced, some months ago, it has been adapted to the making of punches, dies, molds, circular form cutters, and similar parts, with excellent results. The operation of the machine is extremely simple, yet marvelously accurate. The parts are bored, faced, and turned automatically, the only extra requirement being a master template of the contour required, made of thin sheet metal.

After the piece has been chucked and the template attached, the operator sets the tool at the starting point and then presses the directional buttons on the Keller control board. The tracer immediately moves in toward the template until contact is made,

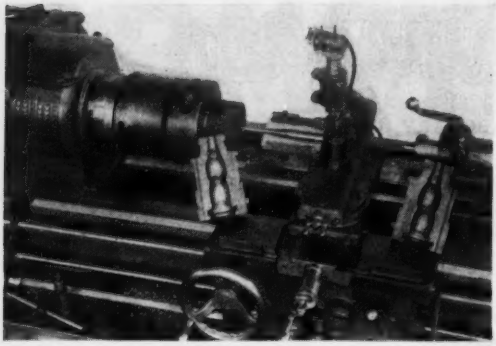


Fig. 1—View showing bottle mold in process, with tracer mechanism and template.

then it proceeds to follow the outline of the template exactly from one end to the other.

The movement of the cutting tool duplicates exactly the movement of the tracer, invariably following the outline of the template within 0.001 in. The tool will take any cut or perform any operation under the guidance of the tracer that it would normally take if operated by hand, and in about one-fifth of the time.

The making of bottle molds is a task for which the Monarch-Keller Form-Turning Machine is particularly well fitted. With the tool following a definite and predetermined course, all lost motion, duplicate movements due to misjudgment, and errors are eliminated. Each and every movement of the tool is productive, with no chance for error and consequent spoilage of work in which a considerable amount of labor cost has already been invested.

In Fig. 1 is shown a bottle mold in process of machining. At the rear of the machine can be seen the electric mechanism that governs the movement of the tool, with the template that is to guide the movement of the tracer. The two halves of a finished mold are shown standing on the carriage. A template is required for each pattern or mold-design, but any number of molds required can be made from the same template. Thus the larger the number of pieces, the greater the saving, although a template can be made and a single piece of work machined at less cost than the machining time would come to if the job were performed by hand.

Fig. 2—Mold for a quart-size container. Machine time, 34 min. Fig. 3—This mold, difficult to make by hand, is simple for the Monarch-Keller machine.

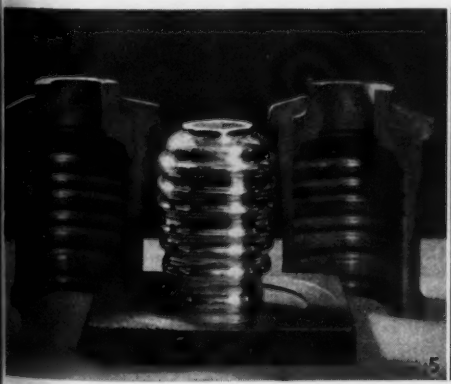
Fig. 4.—An oval three-pint container mold, made by the use of the Monarch oval chuck. The mold was bored, complete, in 1 hr. 40 min.

In Fig. 2 is illustrated a mold for a quart-size bottle, machined on a 20-in. Monarch-Keller machine. As simple as this mold is in design, it can be machined quicker on the Monarch-Keller machine than by the method formerly used. The time, complete, was 34 minutes. The saving made is more than doubled by placing one operator in charge of two machines.

The mold shown in Fig. 3 is a good example of the type of mold that requires an operator's undivided attention when made by hand, but is as simple for the Monarch-Keller machine as the mold pictured in Fig. 2. This mold was machined, complete, in 45 minutes, and was so smooth as it came from the machine that the polishing time formerly required was greatly reduced. An aluminum casting that was made in this mold is shown in the illustration, as is also the template from which the mold was machined.

In Fig. 4 is shown a mold for a container of somewhat more intricate design than those shown in the previous illustrations. This mold is for a three-pint bottle. The oval shape was produced by the use of the Monarch oval chuck, although the operation could also have been performed by the use of the Monarch "Centrode" device.

Fig. 5—Mold for a square glass container. Fig. 6—This mold was finished complete in the Monarch-Keller machine. The outline of the staves was produced by using the shaping tool, governed by the Keller controls.



The horizontal rings on the container were machined in the usual manner from the design on the template. The vertical rings, however, were machined by holding the work stationary and driving the carriage, with the tool slide, by means of the Keller controls. This is a good example of the manner in which automatic shaping can be done on the Monarch-Keller machine. The mold shown was bored, complete, in 1 hour 40 minutes.

The Monarch Oval Chuck is so constructed that, when used with the Monarch-Keller Form-Turning Machine, it can be used to produce irregular contours of oval shape. The chuck is of special value in the machining of such work as oval-shaped bottle molds, dies, punches, or spinning chucks for oval silverware and hollow ware of all kinds.

A glass container of somewhat intricate design and practically square in shape is shown in Fig. 5, together with the molds in which it was cast. Although square, this mold was as easy to produce as though it were circular, although it required the use of the Monarch Centrode device. The finish obtained in the machining was smooth enough so that little hand polishing was required, and the mold was machined in 2 hours 15 minutes.

A barrel-shaped mold in the design of which the hoops and staves are featured is illustrated in Fig. 6. The mold was produced complete in the Monarch-Keller machine, no hand work being done. The contour of the barrel and hoops was produced by the template, which is also shown in the illustration. The outline of the staves was produced by means of a shaping tool that was driven through the medium of the Keller controls while the barrel was held stationary and indexed by hand. The 2 hours 30 minutes required to machine this mold in the Monarch-Keller machine would have been doubled or tripled by the methods formerly used.

While the products shown here are comparatively small, work is handled with the same ease, comparatively, to the full swing capacity of the lathe. The contact of the tracer with the template is so light that there is no perceptible wear on the template, yet the tracer guides and controls the tool through cuts that are limited only by the rigidity of the tool and the power factor. As an example of modern engineering skill and mechanical efficiency, the Monarch-Keller machine stands in the first rank.

Belt Drives With Cast-Iron Pulleys and With Paper Pulleys

"Belt Drives With Cast-Iron Pulleys and With Paper Pulleys," by C. A. Norman and G. N. Moffat, department of mechanical engineering at The Ohio State University, has been published as Bulletin 62 of the University Engineering Experiment Station.

Investigation was made of the transmissive power of oak-tanned leather belts and rubber belts on cast-iron and paper pulleys to ascertain the transmissive power of these various combinations, particularly at small angles of contact. It was found that paper pulleys give excellent transmissive power with both kinds of belts, but that they were particularly effective in improving that of rubber belts.

The paper pulleys make it possible to transmit with 4-ply rubber belts as much as 100 pounds effective pull per inch of width, even with angles of contact as low as 90 degrees, and this without undue tightening of the belt.

A description of the tests, photographs of the apparatus used, and 25 graphs presenting results of the tests are included in this bulletin, which may be obtained without charge by addressing the Director, Engineering Experiment Station, Ohio State University, Columbus, Ohio. Bulletin 62 is priced at 25 cents per copy, but a limited number are available for free distribution.

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Building the Hamilton Watch, II

Cutting teeth on watch wheels—drilling and reaming a 0.007-in. hole—turning 0.0046-in. diameter shaft journals—sawing a 0.006-in. slot.

By HOWARD CAMPBELL

WATCH gears, or "wheels," are punched from strip brass of the correct thickness, as shown in Fig. 11. For this operation a compound sub-press die is used in which the four sections are removed to leave the spokes and the wheel is blanked from the strip at one stroke of the ram. The stock punched from between the spokes passes through the die, but the wheel is pushed back into the opening from which it was punched, to be removed later. In the illustration several of the wheels are shown still in the strip from which they have been punched.

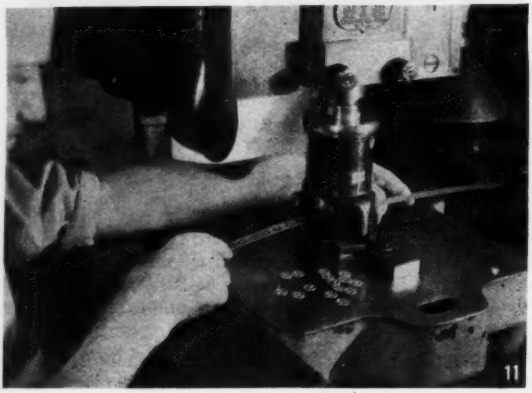


Fig. 11—Punching watch wheels from brass strips, using a compound sub-press die.

The method of cutting teeth on watch wheels is similar to the method used in cutting other and larger gears. A cutter of the correct pitch is used and a single tooth space on an arbor-load of 30 wheels is milled at a cut, the arbor indexing automatically at the end of the cut. The largest wheel on which teeth are cut is the barrel in which the main-spring is coiled and anchored. The force developed by the uncoiling of the spring revolves the barrel and thus sets the train of wheels in motion.

The operation of milling the teeth in a gang of five barrels is shown in Fig. 12, a 260 D. P. cutter being used. Each barrel has 72 teeth, and the five barrels are completed in 10 minutes. When finished, a barrel looks as shown in the upper part of the illustration, Fig. 13, excepting that the barrel is but 0.339 in. diameter.

Pinion teeth are cut in the same manner, with the exception that each pinion is cut individually. The lower part of the illustration shows three of the pinions, photographed actual size and as enlarged six times. The teeth on these pinions are also 260 D. P., which provides a thickness of 0.0039 in. on the pitch line. These pinions are cut at the rate of approximately 35 an hour. In the cross section drawing of the movement of a wrist watch which was shown as Fig. 2, Page 8 of the January issue of MODERN MACHINE

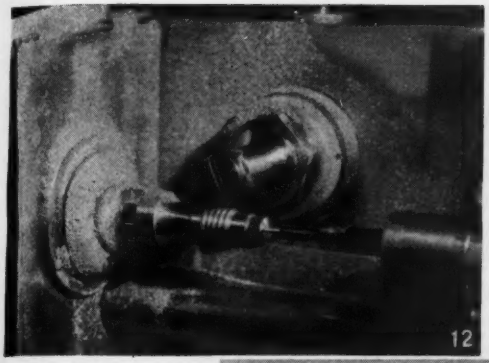
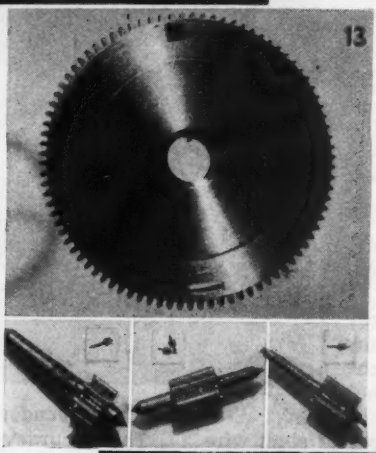


Fig. 12—Milling the teeth in the barrel. Fig. 13 (Above)—Watch barrel, enlarged approximately four times. (Below)—Pinions, actual size and as enlarged. Fig. 14—Bench turret lathe, with which a 0.0072-in. hole is drilled and reamed in the hub of the escape wheel.

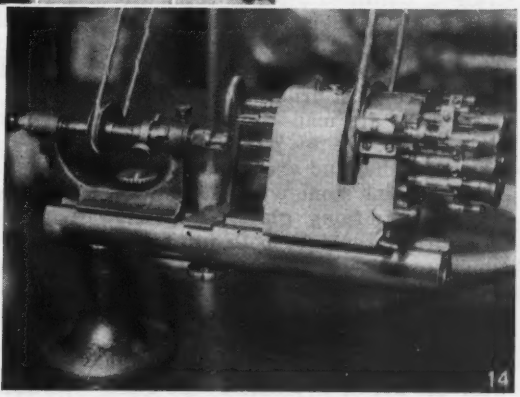


SHOP, these three pinions are indicated by the numbers 28, 34, and 32.

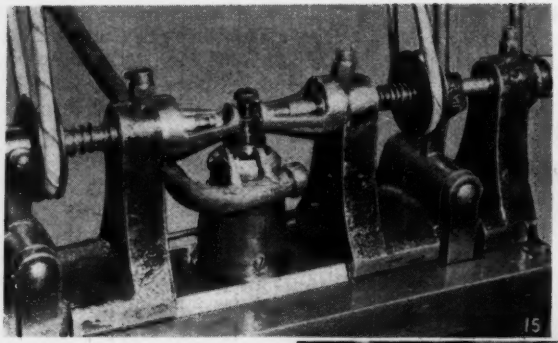
In the center of the hub of the escape wheel (indicated as No. 35 on the drawing referred to above) a hole is drilled and reamed to a diameter of 0.0072 in. As it is necessary that the wheel have a good bearing on the fourth pinion shaft, with which it is assembled, a brass hub is used which is pressed into the hole in the wheel and staked solidly in position. In order to drill and ream the hole in the hub, the wheel is held in a "balloon" chuck on the spindle of the bench lathe illustrated in Fig. 14. This machine is practically a miniature turret lathe.

The wheel is inserted into the chuck through the opening in the side and is located in the taper bore of the chuck, where it is held firmly in position by the action of a spring plunger which extends through the headstock spindle. Even though the wheels may vary slightly in diameter, the use of the balloon chuck insures that each wheel will be located exactly on center.

In the first movement of the turret a stop is brought to bear against the face of the wheel-hub. Regardless of the position of the piece in the chuck, the stop determines the depth to which the tools that follow will operate. Two spotting tools are used to locate the center and effect an entrance for the drill. A 0.007-in. drill is used, followed by a 0.0072-in. reamer.



The hub is then faced and chamfered. for which sapphire tools are used, and



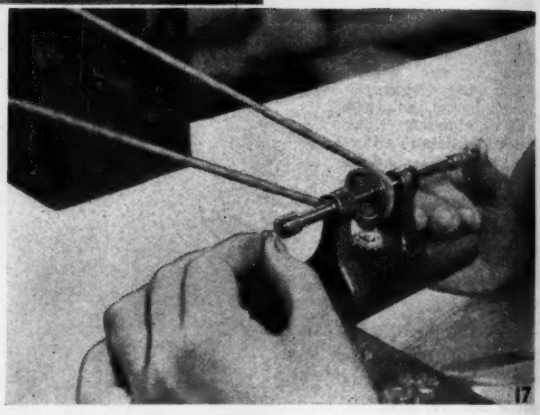


Fig. 15—Two-spindle automatic bench drill with which the balance screw holes are drilled in the balance wheel. Fig. 16—Balance wheel, actual size, and enlarged six times. Fig. 17—With this machine, tapping one hole at a time, an operator taps 2,860 holes per hour in the balance wheel rim.

the piece is reversed and the hub faced on the opposite end.

The tools that are used to drill and ream the small holes in watch parts are all of the same design, each consisting of a straight, hardened piece of steel wire on the end of which two cutting edges have been ground in the same manner as the oldtime "flat" drill which was used before twist drills were invented. These drills are made from wire that is drawn to size by pulling by hand through a die, and are ground on an extremely fine stone with the aid of a double magnifying glass. Obviously, twist drills would be both impossible and impractical on such small work. During the operation described above the work revolves at a speed of 3,000 r.p.m. As stated in the previous article of this series, the operator works with the aid of a jewelers' eye-glass continuously, and must needs have a fine and sensitive touch to avoid breaking the slender and delicate drills.

The accuracy with which a watch performs its function depends to a large extent upon the care and accuracy with which the balancing mechanism is manufactured and assembled. The two major parts of this mechanism are the hairspring, in which the elasticity usually varies with changes in temperature, and the balance wheel, which usually expands or contracts according to temperature conditions. In the latest Hamilton watch the hairspring is made of an alloy in which the elasticity does not vary and which, when used with a balance wheel having the correct temperature co-efficient of expansion, eliminates error which might result from changes of temperature.

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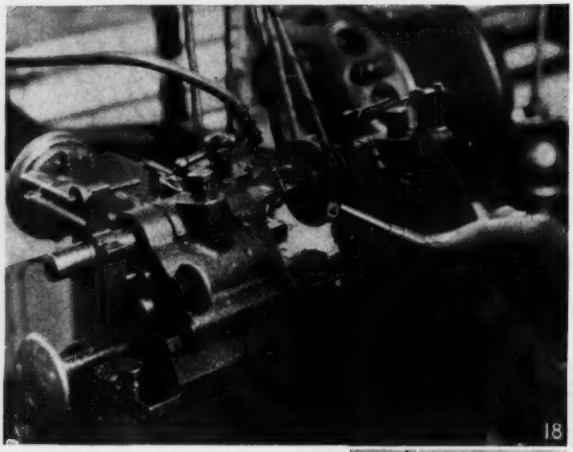
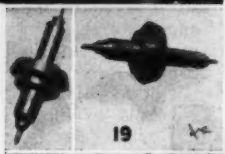


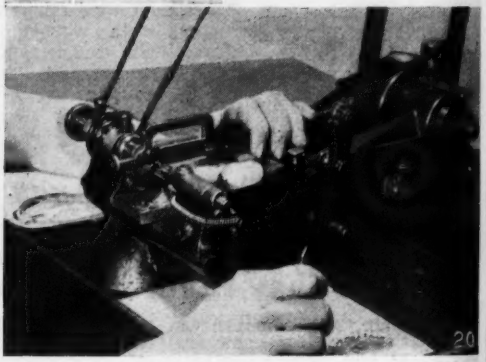
Fig. 18—Rear view of lathe in which the "pivots" are turned on the ends of the balance staffs. Fig. 19—Balance staffs, actual size and as enlarged six times. Fig. 20—Lapping the balance staff pivots. Some 0.0002 in. of stock is removed in this operation.



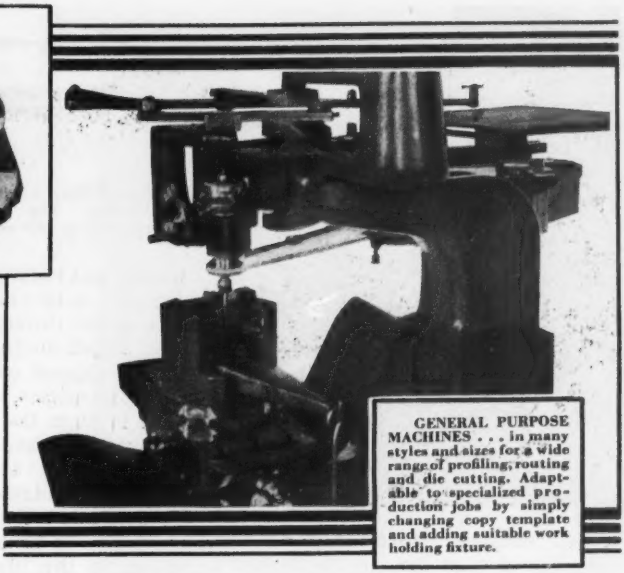
Correct balance is obtained in this wheel by the use of weights in the form of screws which are screwed into holes in the rim of the wheel. The holes for these screws are drilled to 0.010 in. diameter, for which the two-spindle horizontal drilling machine shown in Fig. 16 is used. The wheel is located by means of a pin that is inserted into the center hole, and is held in position by a knurled nut which threads down onto a screw that is split to clear the balance arm. A balance wheel, both actual size and as enlarged six times, is shown in Fig. 16.

There are 22 holes to be drilled; thus the wheel is indexed 11 times. The drills run at a speed of 2,500 r.p.m., and the 22 holes are drilled at a speed of 50 pieces per hour per machine. One operator runs two machines, thus producing 100 wheels per hour. The diameter of the holes is not allowed to vary more than 0.0002 in. As it would be impossible to keep a check on the condition of the drills without frequent stopping for examination, the drills are sharpened after each 100 pieces have been drilled. This number has been found to be about all that can be drilled before the drill loses its edge.

The balance screw holes in the balance wheel are tapped with the equipment shown in Fig. 17. The wheel is located by means of a pin in the center of a table that is the same diameter as the wheel and which holds the wheel at the correct height for the tap. A 0.0128-in., 260-thd. tap is used. The machine consists of a single horizontal spindle, with the tap held in a collet chuck. Power is supplied through the reversing head at the rear of the bench, which is operated by a foot pedal that is controlled by the operator. The withdrawal is spring-con-



Name of part: Refrigerator Cylinder.
Operation: Milling relief.
Material: Nickel Cast Iron.
Stock removed: .010".
Cutter: Special ½" dia. end mill.
Cutter R. P. M.:—3600.
Finish: Smooth and clean cut.
Limits: All dimensions plus or minus .001".
Production: 200 pieces per hour.
Actual Cutting Time: 12 seconds each.
Machine: Standard Gorton 3-Z with special work holding fixture and steel copy template.



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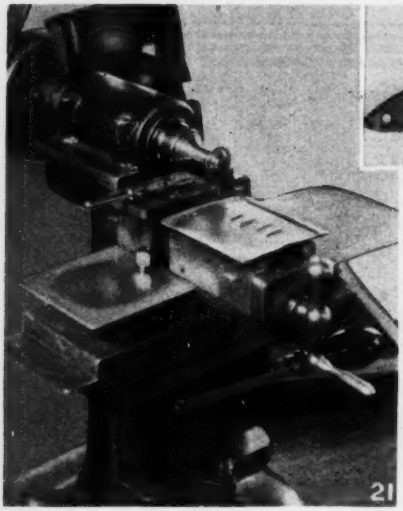

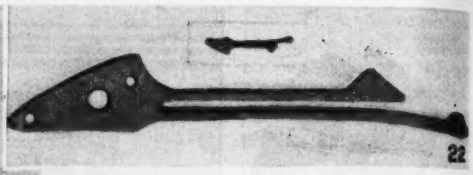

Fig. 21—Milling a 0.006-in. slot in the setting lever spring. Fig. 22—Setting lever spring, actual size and as enlarged six times.

trolled, making it necessary for the operator to feed the spindle forward only, which she does by pushing it with her thumb. The tap is changed after each 100 holes have been processed, thus making sure that each hole will be within 0.0002 to 0.0003 in. of standard size. Remarkable as it may seem, an experienced operator taps the 22 holes in a wheel at a rate of 130 wheels—2,860 holes—per hour.

The operation shown in process in Fig. 18 is that of turning the "pivots" (which on a large shaft would be called the journals) on the ends of the balance staff. The machine is shown from the rear so as to obtain a clear view of the operation. The staff is 0.167 in. long, and the pivots are each turned to a length of 0.013 in. and a diameter of 0.0046 in., plus or minus 0.0002 inch.

The piece having been made in an automatic screw machine, the pivots have been rough turned and tapered to a point at each end. For the finish-turning operation, the staff is clamped into a dog and the ends of the pivots are slipped into female centers in the spindle and tailstock of the lathe. The dog is a split clamp, pulled together by a screw through the open end and with a hole in the opposite end that can be slipped over a projecting lug on the faceplate. The wrench that is used to turn the screw consists primarily of a handle, with a socket in the end that fits the head of the screw. In addition to serving as a wrench, this tool is also used to handle the pieces in and out of the lathe, as shown in the illustration. Two balance staffs are shown, as actual size and as enlarged six times, in Fig. 19.

After turning, the pivots on the balance staffs are polished with the aid of the machine shown in operation in Fig. 20. The staff is revolved at high speed in a bench speed lathe while the cast iron lap, to which a mixture of fine abrasive and oil has been applied, is reciprocated over the pivots. The necessary amount of pressure is applied and regulated by the operator's hand, as shown. Approximately 0.0002 in. of stock is removed in this operation, allowing a tolerance on the finished diameter of minus 0.0001 inch.

A bench miller is shown in Fig. 21, set up to mill the slot in the setting lever spring. A spring is reproduced in Fig. 22, as actual size and as enlarged six times. In this operation the piece is held in a fixture consisting of a plate in which a recess of the proper shape has been cut, and a sliding wedge with which the piece

(Continued on page 64)

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THIS strong, durable fast cutting polishing grain—the grain with "surface tenacity"—is also making records for itself in polishing non-ferrous metals.

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NEWS

49 Central Avenue, Cincinnati, Ohio

INDEX

HYDRAULIC UNIT

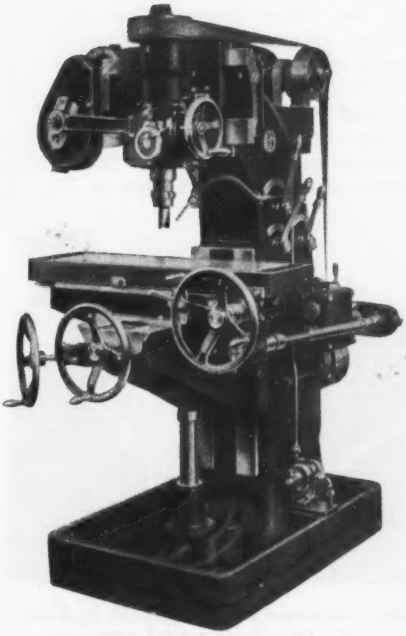
INVESTIGATE THIS MACHINE

For Making Your Plastic Material Molds

SCORES of plastic molders throughout industry have found that the cost of making molds plays an important part in their program and is often the deciding point between PROFIT and LOSS in a molding job. The "HURTH" Vertical Milling Machine has solved this difficulty by REDUCING mold costs and improving their quality.

Experience has proven that this dependable service is assured by the many features included in "HURTH" Design. These features include a Patented Compensated Crank Drive with uniform, reciprocating motion of cutter slide; Automatic Down Feed of cutter spindle with automatic release at predetermined depth; Cutter Spindle entirely free of Belt Pull; and many others.

Investigate this machine for making your molds. Find out how these "HURTH" features will lower your mold costs and give you better finishes. Write to the Index Machinery Corporation, 49 Central Avenue, Cincinnati, Ohio, for complete information and illustrated bulletin.



"HURTH" Vertical Milling Machine

Redesign for Arc Welding Improves Product and Lowers Costs

The Dake Engine Company Uses Advanced Method of Construction

A METHOD by which the progressive industrialist can improve his product and at the same time lower his production costs—two factors that are paramount in the face of the new competition—has been demonstrated by the Dake Engine Company, of Grand Haven, Michigan. This company recently announced the redesign of its hoists from cast iron to arc welded steel construction.

The new hoist of steel offers the maximum of efficiency, the small motor-driven model shown in Fig. 1

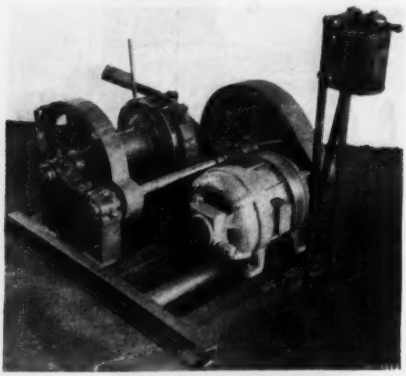


Fig. 1—Stronger and lighter is this Dake hoist, built of arc welded steel.

gaining its full capacity with the arc welded steel mounting. The motor is a 2 h. p. Lincoln DL type, made to run 1,200 r.p.m., and the mounting of arc welded steel is much lighter and stronger than the cast iron mounting previously used. This unit with gear changes has the following capacities:

1400 lb. at 35 ft. per min.
970 lb. at 50 ft. per min.
740 lb. at 65 ft. per min.

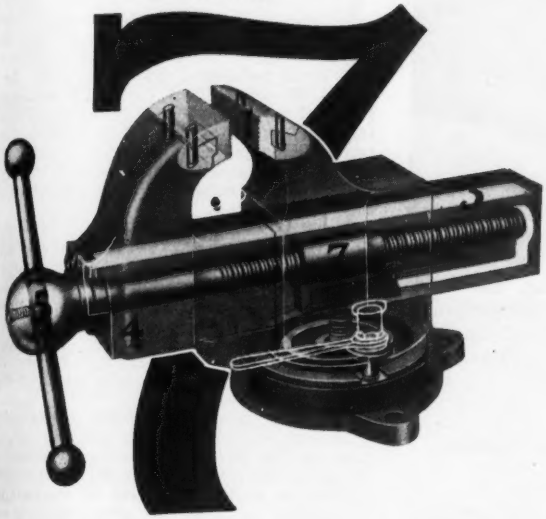
The details of the arc welded construction can easily be seen in the illustration. The sides are of 3-in. channels, and three 2½ x 2½-in. angles are used as cross members, together with a tubular cross member of 2-in. steel pipe. The vertical members are of ¼-in. plate.

The specifications for welding called for the thickness of the weld metal to be at least as thick as the plate upon which the weld was to be made. The lineal length of the weld was computed from tables in "Arc Welding—The New Age in Iron and Steel," published by the Lincoln Electric Company, of Cleveland, Ohio, whose "Stable Arc" welders and electrodes were used by the Dake Engine Company.

Engineers of the same company have redesigned their larger units for steel construction, also. One of the units—a double drum hoist—is shown in Fig. 2. The sides of this hoist, which carries a 15 h.p. gasoline engine, are of 5-in. channels. Four 3 x 5-in. angles and a section of 3-in. pipe serve as cross members. The vertical members are of ⅜-in. plate. Here again bolts and rivets are used only where interchangeability of parts is desired.

It is stated that the use of steel

This Deserves Executive Attention



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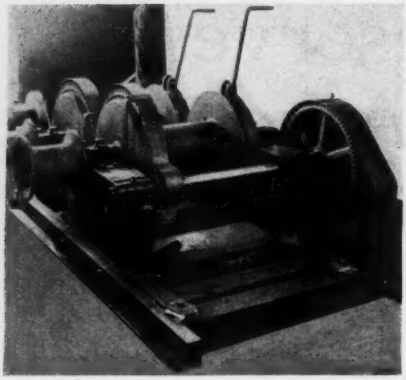


Fig. 2—A Dake double drum heavy duty hoist. Bolts and rivets are used only where interchangeability of parts is desired.

fabricated by arc welding, has made possible a stronger and more durable product at less weight, and has lowered the cost of production materially.

Ruminations of a Hobo-Machinist

"TH' best foreman I ever worked f'r was the feller I served my time under; wasn't much at rushin' around and didn't give many orders, but when he **did** give one he knew what he wanted an' why.

"Had a queer way of hirin'; more'n likely he'd turn down half a dozen all-round men an' hire one that hadn't had much experience. He sed brains was more important th'n experience; if a man had brains you could give him th' experience, but if he didn't have brains it didn't make no difference how much experience he had. Sed you could take a good man an' make a mechanic out of 'im, but you couldn't take a poor mechanic an' make a man out of 'im. An' then he'd spend a lot o' time showin' the new guy jest what he wanted and how t' do it, 'til he had the feller doin' things his way.

"Took a lot o' the boss's time fer a while, but it seemed t' pay in th' end. He had the best lot o' mechanics I ever worked with, an' if my feet didn't git t' itchin' about every so often, I'd of been there yet."

"Running a Regal"

A manual of lathe operations and the maintenance of the modern geared-head engine lathe, entitled "Running a Regal," has been published by The R. K. LeBlond Machine Tool Co., 2700 Madison Road, Cincinnati, Ohio. The manual contains 72 pages 5¼ x 8 in. in size. It is intended to present the basic principles of lathe operation to the student, the apprentice, and others who are mechanically inclined.

Starting with a chapter on "How To Set Up the Lathe," the text carries the reader on through complete, but plainly-written, descriptions of the design and functions of the headstock, spindle, spindle speed gears, quick change feed mechanism, reverse plate, quadrant, apron, lead screw, carriage, compound rest, tailstock, and all other parts of the lathe.

The text then takes up the accessories and tools required in the use and operation of the lathe and includes descriptions of the use of caliper, micrometer and other tools. The uses of the cutting tools and methods of grinding are included. The various methods of holding

work in the lathe are discussed, together with methods of centering. The subjects of boring, threading, drilling, knurling, reaming, and tapping are taken up in turn and each operation is described in detail.

The book closes with a number of useful tables for the lathe operator. There are 92 illustrations showing the parts of the lathe, tools, set-ups, and operations in process. The price is 25 cents.

R add to card in file

Characteristics of Alloy Steels, III

Troubles Encountered in Heat Treating—Soft Spots—Brittleness —Distortion—Warping—Cracking—Pitting

By GEO. M. ENOS
Assistant Professor of Metallurgy, University of Cincinnati.

IN previous articles it has been noted that alloy steels are generally used in the heat-treated condition. Certain troubles or defects may develop during treatment or use, and while these may also occur in plain carbon steels, it is worth while to discuss the origin of the defects and methods by which they may be avoided or corrected.

The steel may be **too soft** for the use for which it is intended. This trouble is detected by means of a hardness or wear test, and may be due to a number of causes. The steel may have been heated at too low a temperature, or cooled too slowly from the proper temperature, or held too short a time at the correct temperature, or it may have been heated to too high a temperature, either on hardening or in the tempering operation. If an improper analysis is used, the softness may not be the fault of the heat-treater, but in all other cases the fault can be traced to careless heat treating. The remedies are obvious.

Soft spots are sometimes encountered in hardened work, and this defect is generally traceable to the heat treating operation, unless the steel is found to contain inclusions or segregations. Scale adhering to the piece will insulate the hot steel in spots when it is quenched. The quenching bath may be in poor condition. The steel may have been heated in some packing material and the heat distribution through this material be uneven, resulting in unevenness of temperature in the steel at the moment of quenching.

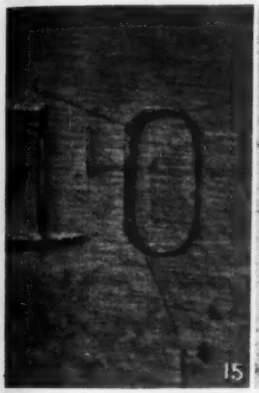
The steel may be **too hard**, which is usually due to too drastic a quench or to insufficient tempering.

The steel may be **too brittle**. This condition may be due to too large a grain size, to segregations, to improper drawing temperatures after quenching, or to improper analysis. Large grains can be refined, drawing temperatures can be changed, and a steel of proper analysis can be substituted. But segregations cannot be remedied by heat treatment; they comprise a manufacturing defect in that they are included in the steel in the process of manufacture, and cannot be eliminated.

One of the most vexing of the problems that arise in the heat treating of steel is the avoidance of **distortion** and **warping**. These phenomena are caused by shrinkage and expansion other than that expected. It is well known that the kind and extent of the working operations prior to machining, or even the machining operations themselves, may leave the steel in such a condition that a hardening treatment will cause warping. If the work is not properly supported in the furnace it may sag under its own weight. Naturally the heat treatment must be correct for the analysis used, and sometimes warping or distortion occurs because, through error, the

piece is made from a steel of different analysis than is specified for the job.

Distortion and warping may also be caused by too rapid a heating or improper heat distribution in the furnace, or through use of a poor quenching method. So far, the design of the section undergoing treatment has not been mentioned. Many complicated sections will warp or distort in spite of the utmost care in heat treating, due to the nature of the design.



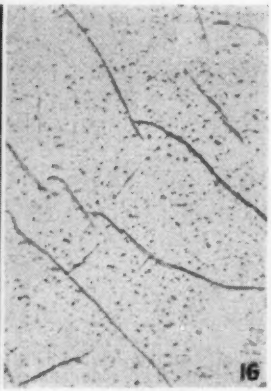


Fig. 15—Photomacrograph of portion of a high speed steel tool which cracked in hardening. Note that the cracks originate at the impression made by the steel stamp. Magnification, 4 diameters. Fig. 16—Photomacrograph of surface of a die showing cracks that developed due to incorrect tempering practice. Etched ½ hr. in boiling hydrochloric acid to develop the cracks. Magnification, 4 diameters.

One of the most troublesome of the defects encountered is **cracking** of the piece. If the cracks develop in the hardening room, they may be traced to errors in the heat treatment or quench, or in selection of the steel, assuming that the design is correct. Often, however, some or all of the pieces crack because of the design. Tools should be designed so as to avoid sharp corners and re-entrant angles. Any sharp corner, however small, such as rough tool marks or chisel marks, may cause trouble. Figure 15 shows a photomacrograph of a portion of a high speed tool which cracked in hardening. It will be noticed that the cracks originate at a number which has been stamped on the shank. Not all steels are so sensitive to these small impressions, but the sinking of identifying marks on a tool by means of a die may lead to trouble.

In connection with design, it is advisable also to avoid uneven distribution of section; that is, thin sections should not change abruptly to thick sections in work that is to be h a r d e n e d, since strains will be set up in the quenching operation which are likely to result in cracks. Even when the design is reasonable, the quenching i n t r o d u c e s enormous strains which must be relieved by tempering. If the tempering operation is carried out at too low a temperature, or for too short a time, fine cracks may be developed which will escape immediate detection, but which will be discovered later when grinding the tool or otherwise preparing it for service. In Fig. 16 a network of cracks is shown on the smooth face of an alloy steel die. These cracks were visible on grinding, and were developed as shown by etching deeply. They are due to insufficient tempering.

The structure of a high speed steel, insufficiently tempered, is shown in Fig. 17 and 18. While the tempering may have been sufficient to partially relieve the stresses that were set up in the hardening operation, such a structure is undesirable as cracks

might develop in service. The grain boundaries as shown are clearly visible; these boundaries should not be apparent if the hardening and tempering operations were correctly carried out. Compare with Fig. 14.

Not all cracks are the result of heat treating; cracks may also be developed in the grinding operation if the grinding is not done correctly. It is sometimes difficult to decide whether fine cracks are the result of improper grinding or improper heat

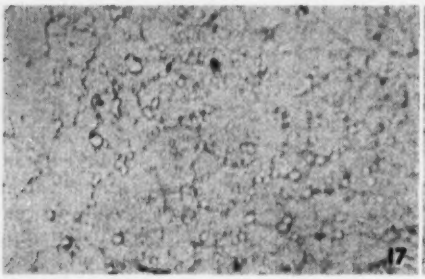


Fig. 17—Photomacrograph showing the structure of a hardened high speed steel, not tempered, or insufficiently tempered. Magnification, 400 diameters. Nital etch. Fig. 18—Same as Fig. 17, but at a magnification of 2,000 diameters.

treating, or a combination of both causes.

A scale may be formed during the heat treatment which may be harmful if excessive in amount or if it adheres tightly in a few places and flakes off readily over much of the steel. When this happens, soft spots will result. Scale, as such, cannot always be avoided, but the maintenance of a correct furnace atmosphere will do much to control the nature and limit the amount of the scale.

Pitting is sometimes observed on the surface of steel after heat treating. Usually this condition is due to segregations or inclusions in the steel, and is noticed after the steel is cleaned up by grinding or by other methods.

Close temperature control is essential in heat treating operations. If the steel is under-heated at the time of cooling, it is likely to be incompletely hardened and in a badly strained condition. If it is overheated, the grain size will be too large; indeed, actual burning may occur.

The furnace atmosphere is very important in heat treating. In the preparation of tool steels for the market, the finishing operations of which the heat treatment is a part, are likely to leave the stock with a surface layer which has less carbon than the body of the steel. This condition is known as decarburization and is caused by the furnace atmosphere reacting with the steel surface in such a way as to remove a large part of the carbon. While this condition might be avoided, the cost would be increased considerably and since it is expected that the steel will be machined anyway, the decarburized layer will normally be removed before heat treatment of the tool or die. If the decarburized layer is left on the steel, it may cause warping, soft spots, or actual cracking.

The depth of the decarburized layer may be as much as 7/8 in., although such a depth would, of course, be very unusual. It is necessary that the entire layer be removed, therefore it is important to know how

much of the surface must be removed in machining. On large pieces that are to be used for making dies, one shop makes a practice of removing approximately 1 in. of stock from one surface and then working to that surface from the opposite side, making sure that at least 1 in. of stock is taken off all around. In many cases it is not necessary to remove so much material. A test piece, taken from the end of the bar and hardened, should reveal the depth of decarburization, as well as other information such as the grain size resulting from the heat treatment, as noted by the eye, on the fracture. Fig. 19 shows the decarburized surface of a high speed steel.

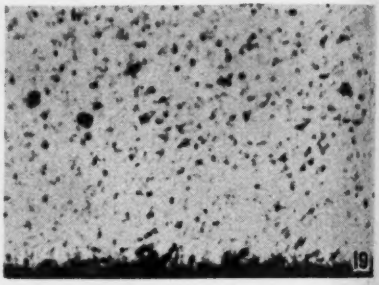


Fig. 19—Photomacrograph of the decarburized portion of a hardened high speed steel. The decarburization was not removed before hardening, and the tool cracked in the hardening operation. Compare with Fig. 14 to see difference in structure. Magnification, 100 diameters.

While dies or tools may be case-hardened or nitrided, the troubles and defects encountered in these operations will not be discussed here. In conclusion, it may be stated that in dealing with alloy steels suitable for use as tools and dies there are a great many variable factors which influence the final condition of the tool or die as it goes into service. It is very essential that the designer, the steel maker, the heat treater, and the machinist co-operate in order that the best results may be obtained.

Durant Manufacturing Company Summarizes Actual Costs of Individual Jobs

By J. J. BERLINER

BY using the special form reproduced below, the Durant Manufacturing Company, Milwaukee, Wisconsin, summarizes the actual cost of each lot of pieces in the order in which they are finished. The variations in the product of this company are such that standard costs, based upon average costs, cannot be used.

In describing the uses to which this special form is put, W. L. Weifenbach, of the Durant Company, said: "Possibly before describing the working of the form, something concerning the nature of our business would be in order. We are manufacturers of small parts and mechanical counting machines, which necessitates manufacturing to stock for our so-called standard models and manufacturing to special order for special machines.

"Special machines might contain standard parts and also special parts. We have in our stock room about 4,500 different kinds of parts, including single pieces, sub-assemblies, and main assemblies or finished products. All of these, including the single pieces, represent investment for labor, material, and overhead.

"Our production is run through in the usual manner, with material requisitions on the stores department and a job ticket for each job in the shop. This system is carried through to the completion of each job, material being entered on the cost record card and, when finished, transferred to the Cost Summary Card.

"Experience has taught us that we can obtain the best results by taking the costs of the pieces in sequence as finished, and not the average cost; that is why the Cost Summary Card was designed. It makes it possible for us to tell exactly what is causing the increase or decrease in costs on any particular model. The parts that

DURANT MFG. CO.

Model 13X **COST SUMMARY** Pc. No. 3032 OBX

Description Number Wheel Assembly

Date	Order No.	Pcs. Started	Pcs. Finished		Material	Labor	O. H.	Cost Each
5-3-29	38729	2000	2000	760-42-44-35-1103-16	.0737	.0207	.0226	.1170
6-10-29	39306	2000	2000	497-125-416-28-27707	.0994	.0276	.0303	.1573
6-11-29	39141	2000	2000	16-1000-945	.0994	.0276	.0303	.1573
6-28-29	39441	2000	2000		.0932	.0267	.0295	.1494

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HERE is a New Machine, which will both improve the quality of your Hourglass Steering Worms and CUT THE COST OF PRODUCTION.

Cutting is continuous, achieving extraordinarily high production. Owing to the ideal application of the Gear Shaper Cutter—the machining action is highly efficient, and enables the attainment of a smooth finish at a HIGH RATE OF SPEED.

ACCURACY is unimpaired by resharpening the cutter. A side-trimming mechanism holds the thread proportions under constant control. The required profile is maintained throughout the entire life of the cutter.

Simplicity of loading and ease of control contribute to the overall economy of this Fellows Production Unit. For complete description and specifications, write: THE FELLOWS GEAR SHAPER COMPANY, 78 River Street, Springfield, Vermont. (616 Fisher Building, Detroit, Michigan.)

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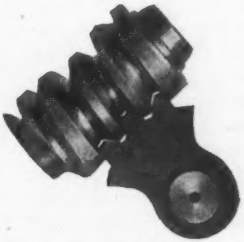
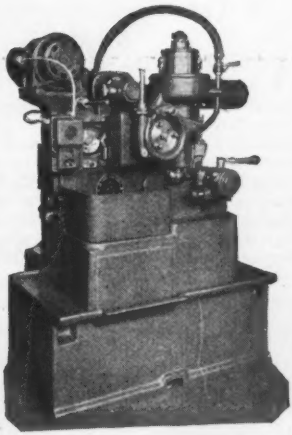


Hourglass Steering Worm and Helical-tooth Sector.



Front view of Fellows Hourglass Thread Generator for cutting Hourglass Worms at a high rate of production.

go to make up the finished product vary in number from 50 to 100 pieces.

"When the sales costs are made up, the amount of parts used is deducted and listed in the center column of the form. In this way we keep track of and use the actual costs on each individual lot of material before we start on the next lot.

"All lots of material not completed at the end of the month are charged into the work-in-process account, but are not entered on the Cost Summary Card until completed. This because we have found that we are constantly bettering ourselves on production time, and we secure a more accurate cost in this manner than we could by using an average cost.

"We keep our inventory record both by the number of pieces and by the monetary value, which, as we close our books each month, ties in with our general ledger account. The cost that is put through the cost of sales is the actual cost of the parts produced, which reflects, as closely as possible, our efficiency.

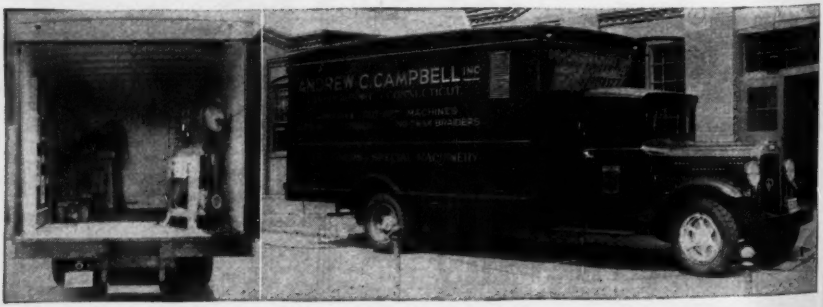
"We appreciate the fact that we are not using standard costs. However, the additional labor necessary to install a standard cost system, with the necessary time study work, and so on, would greatly increase our overhead, and as our organization is not large enough to overcome this difficulty, we use the system here described. It forms a basis of control, and works out to our entire satisfaction.

"In charging overhead into our inventory work-in-process account, we use a so-called normal overhead and the difference between the normal and the actual overhead is charged out at the end of the month. This leaves the burden in the inventory always at the same figure to take care of fluctuation in the costs of material, labor, and the like."

A Traveling Demonstration Booth

ACTING on the principle that a convincing demonstration is the best possible method of informing prospective buyers as to the merits of their products, Andrew C. Campbell, Inc., Bridgeport, Conn., has set up a complete demonstrating exhibit of Campbell machines in the vehicle shown below. The demonstration booth is driven right to the door of the industrial plant and the buyers are given an opportunity to see what the machines would do in their own plant. This method not only shows the quality of the work done on the machine, but it enables the prospect to process pieces of his own work and thus determine by actual demonstration what results may be expected.

Ample room is provided in the body for the operation of the machines and for several persons at the same time. Amidships, between the driver's cab and the demonstration room, is located a complete generating unit with which power is produced to drive the machines.



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Summed up, PRECISION—in NORMA-HOFFMANN Bearings—means longer life, less liability to shut-down losses, lowest cost per bearing per year of service. This is a fact attested by actual records in hardest service over a long period of years. It is good business, as well as good engineering, to use PRECISION Bearings.

Write for the Catalogs—and let our engineers help you.

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NORMA-HOFFMANN BEARINGS CORPORATION, STAMFORD, CONN., U.S.A.

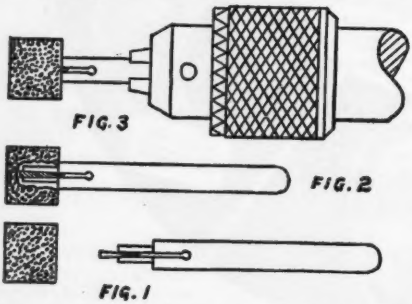
Ideas From Readers

This department is a clearing house for ideas. If there is a "kink" or short cut in use in your shop, send in a description of it. We will pay $5 for each one published.

Attaching Small Grinding Wheels to Spindles

By F. B. HELANDER

ANY mechanic who has had much experience in the grinding of small holes is familiar with the difficulties that are often encountered in attaching the grinding wheel to the



Drawing illustrating method of mounting small grinding wheels.

spindle. In some cases the wheel has been cemented or shellaced to the spindle, but this practice is unsatisfactory due to the fact that the cement or shellac gets on the face of the grinding wheel and destroys the cutting efficiency of the wheel. Or else the heat that is generated in the grinding or truing of the wheel loosens the cement or shellac and the wheel comes off.

The drawing illustrates a method that has been found very satisfactory for attaching small wheels from 1 in. diameter with ⅜-in. hole down to ¼ in. diameter with a ⅛-in. hole. The small diameter of the shaft is turned to fit the hole in the wheel, then a small hole is drilled and the spindle is slotted, after which a wedge is made to fit the slot. The spindle is now ready, as shown in Fig. 1, to mount the wheel. The shaft and wedge should be tapped into the wheel together. Forcing the wedge into the slot tightens the shaft securely in the wheel, as shown in Fig. 2. In Fig. 3 the wheel is shown in the chuck of the grinding machine, ready for use.

Scale Attachment for Adding Fractions

By R. H. KASPER

THE illustration shows a scale attachment which the mechanic will find helpful. The purpose of the attachment is to aid in adding or subtracting fractions or compound numbers, quickly and accurately, without the use of paper and pencil. Fractions may be added or subtracted directly without the necessity of converting them into common denominators.

Two steel scales are slideably held, edge to edge, by the parts **A** and **B**. Part **A** is attached to the lower scale by a screw that passes through the two ears, the upper scale sliding in the groove provided for it. Part **B** is free to slide over both scales.

The attachment is used as follows: In the illustration the figures being added are 19-32 and 15-32. The upper scale is pushed to the left through

(*Continued on page* 41)

Metal Cutting Methods

By Simonds Saw and Steel Co.

How To Operate High Speed Steel Hack Saws

HIGH speed steel hack saw blades are production saws which every shopman should consider high-grade edge-tools of the first order. As such they should be kept in the very best condition.

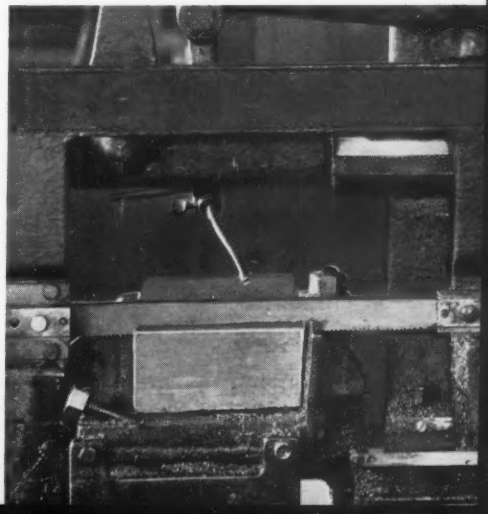
While the term high speed steel is generally applied, it should not be confused with the number of cutting strokes of the machine per minute because the rate of production depends directly on the rate which the blade goes through the work. Therefore, much depends on the operator's own judgment as to the practical amount of feed and pressure necessary to be applied. Only by comparison can the exact feed and speed be determined for the individual machine, kind of material to be cut and the type of blade in use.

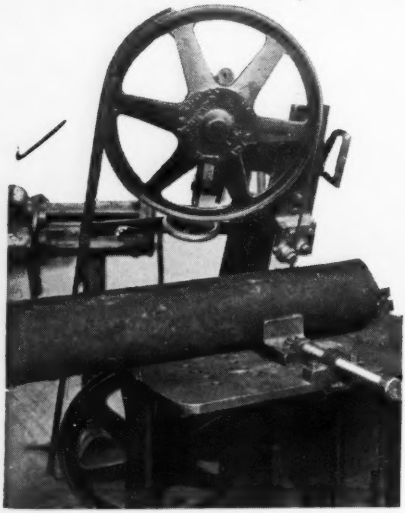
It is good practice in securing maximum efficiency, to increase the pressure as the saw dulls, thereby assuring a cutting rather than a rubbing action along the blade edge. Obviously more pressure should be used when cutting heavy stock than for lighter material.

In power hack sawing it is essential that a cooling compound be used. As the principal action of the compound is for cooling, there is sufficient lubrication with even the low grade cutting compounds, provided the quality produces the necessary cooling effect. Deluge to keep the cut free from chips and also to keep the cutting points of the blade cool so that chips will not weld to them. Through the use of a cutting compound and Simonds Red Streak High Speed Steel blades production is generally increased from six to ten times.

Hack saws like other fine cutting tools will break, but we find that most fractured blades are broken before they are worn out because of either carelessness on the part of the operator or improper adjustment in the machine. In most cases breakage is due either to excessive pressure applied in cutting a small surface as the blade gives at the point of contact and buckles. Another common cause of broken hack saws is too weak strain on the blade. A third cause of breakage is cramping or binding in the cut. This is due to work being held insecurely.

Standardize on first-class tools, preferably Red Streak High Speed Steel Hack Saws—the blade trade marked with the red back edge—and be sure to select the proper number of teeth to the inch for the particular kind of cutting you wish to do. Should there be any doubt about this point ask a Simonds dealer





Does Soft Metal Wear Band Blades Faster?

TO obtain maximum efficiency from your metal band saw, the machine should be in proper shape. It should be adjusted carefully. The wheels should be in alignment and properly faced with the guide rolls true and in adjustment, allowing a minimum of friction from the side guides. Frequently the bottom wheels are not in line with the upper wheel and need refacing, thus causing much friction in the side guides. The result is that saw blades are worn on the back and sides, which in many cases causes a wabbling effect, resulting in a poor cut with an extreme burr.

This wabbling motion dulls the blade quickly.

Many operators erroneously believe that metal band saws cutting soft material should give longer life regardless of the fact that hard metal is also cut with the same blade. This is not the case as soft metal has a tendency to fill the saw gullets of a fine tooth saw, causing it to rub instead of producing the natural cutting action. Consequently blades wear out more quickly. It is good practice to use a new saw to cut the soft metal and when too much burr is evident apply the same saw to cut hard metal until it is worn out.

Much depends on the manner in which the machine is maintained and to a great degree on how the operator feeds it.

We Hear

Eddie Cantor is running for President via the "Mike" and the air is all cluttered up with funny facts and "wise-cracks." They're very good, but we venture to say that some of them may need a little smoothing out. To Eddie and his partner, Jimmie, we suggest that there is no better method than filing some of them down. A Simonds is the one file that will put an edge on them. Mechanics use it for difficult cutting.

* * * *

To "Winchell's bad little boy, Walter" — Smoke a Snarsy Natural and don't worry. Los Angelees, Los Angelus or Los' Paradise — they're all in "Californy." So are Simonds Saws. You'll find them all the way from the waving pines of Maine to the sunkist timber tops beyond the Golden Gate. No, Hell Gate is exempt.

* * * *

Good to the last drop and longer if the drop is no farther than from the top of the Empire State Building to the "Sidewalks of New York." That just about expresses our idea of the tough, wear-resisting quality teeth in that new Simonds Inserted Tooth Metal Saw. Ask us about it.

* * * *

Simonds Hard Edge Metal Band Saws — they work when you want 'em to — not while you sleep, but what mechanic wants to go to sleep when one of these saws is slicing off metal at such speed and feed. It's the steel and workmanship that makes a Simonds blade so wide-awake.

* * * *

A cold saw that's the "hottest member" in the metal sawing field — Simonds Inserted Tooth — the Red Streak blade with the scientific curved gullets. Ask us about it.

* * * *

The more we hear the radio crooners the less we feel like shooting the saxophonist.

Facts To Know About Files

FILE cutting depends on the exactness with which the teeth of the file are formed and on the knowledge and heat-treatment of metals on the part of the makers, when it is hardened.

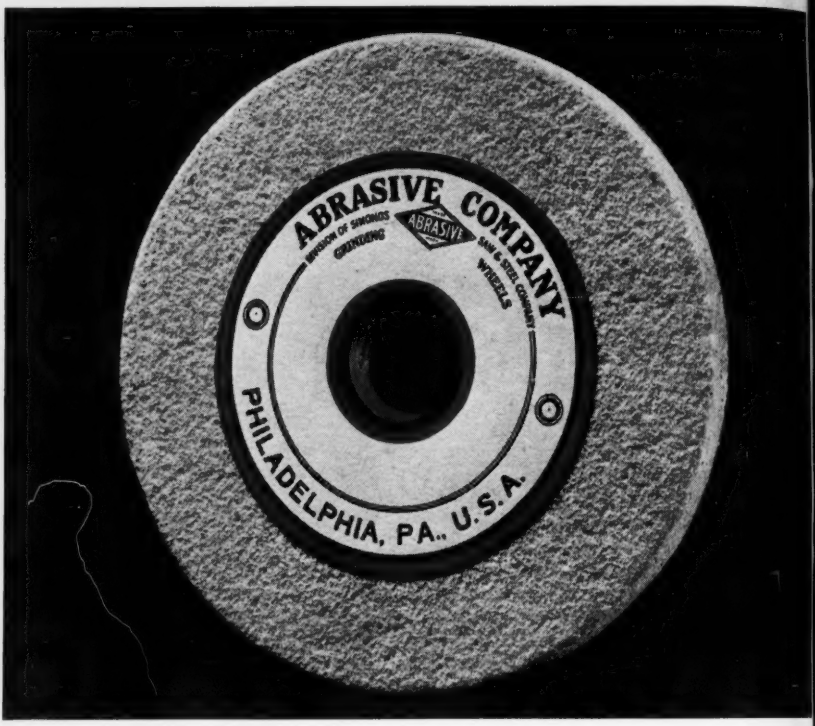
Regular standard files have two divisions — saw files and machinists files. Saw files are single cut. Machinists files are usually double cut. A double cut file will cut faster than a single-cut but the latter gives a smoother finish.

If you want to see just where the file is cutting change the direction of the stroke.

Hard spots and hard corners on iron castings are hard on files. On such work go over it a few times with an old file before putting your good file on the work.

The oil with which new files are lightly coated should be removed before using the file on cast-iron. This will make the teeth cut more easily. On fibrous material the oil helps.

Why not have a rack for your files instead of throwing them in a pile. It's file economy.



Tool Rooms Accept ABRASIVE CO. "W" Wheel

—faster Cutting than any before

You can feel and see the cutting action of the "W" wheel as it feeds into a hard tool steel surface.

The skilled toolmaker can tell it's better. But the actual comparison is even more convincing.

Write us for more information concerning this new "W" wheel.

ABRASIVE COMPANY
DIVISION OF SIMONDS SAW AND STEEL COMPANY

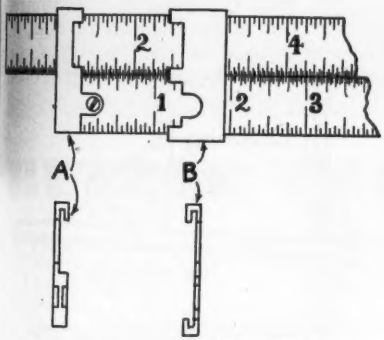
Tacony & Fraley Streets
Philadelphia, Pa.

Ideas From Readers

(*Continued from page 36*)

part **A** until the graduation 19-32 registers with the indicating edges of part **A**. Part **B** is then moved to the right until the indicating edges register with the graduation 15-32 on the lower scale. The result, 17-16, is read at the indicating edges of part **B** on the upper scale.

If more fractions are to be added, part **B** is held in place on the upper scale and the lower scale is moved to the right until parts **A** and **B** make contact. Part **B** is then reset to the proper graduation on the lower scale, and the new total is read on the upper scale. Subtraction is performed in the reverse order. It will



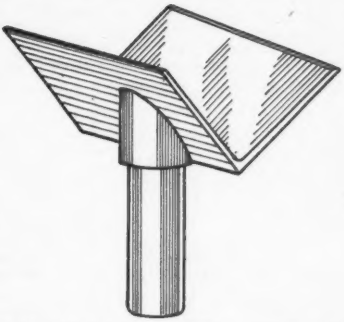
Scale attachment for adding fractions.

be noted that parts **A** and **B** are open at the back, permitting either part to be held firmly with the fingers while the other part is being reset.

Welded Drilling Fixture for Round Parts

By C. T. SCHAEFER

A SIMPLE drilling fixture that will accommodate a wide variety of work can be made quickly and easily by using the welding torch and scrap parts picked out of the scrap bin or from around the shop. Such a fixture is shown in the illustration. The V-groove for holding round work is



Welded fixture for drilling round parts.

formed from a short length of angle iron, and the shank is turned from round stock. A V-groove should first be cut in the end of the bar so that the angle will fit into it properly, then the angle iron should be welded in place.

With the pieces welded together, the assembly should be placed in the lathe and the shank turned to fit the hole in the center of the drill press table, taking care to obtain a full bearing at the shoulder, which is at right angles to the axis of the shank. The hole in the machine table then locates the fixture centrally, while the V-groove automatically fits all diameters.

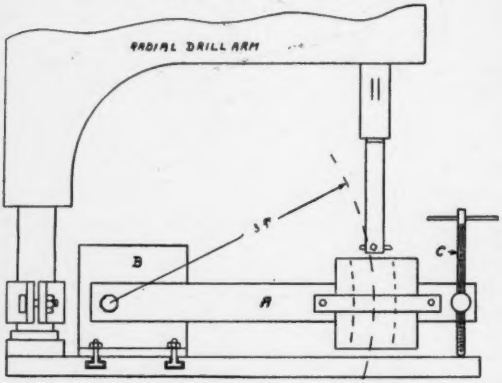
Boring a Curved Hole

By CHARLES KUGLER

IT is not often that anything is designed with a curved hole in it, but it was the writer's luck to be given the task of boring a curved hole in a mold. The mold was a casting, in which the hole was cored with ⅛ in. of metal to be removed in the finishing operation.

The only machine available for the job was a radial drill press, which

was fitted up as shown in the illustration. The mold was attached to the wide and heavy bar **A**, which was pivoted to the angle plate **B** so that the center of the hole came on the desired radius, which was 3 feet. The bar was raised and lowered, swinging the work through the 3-ft. arc, by means of the hand screw **C**, which was threaded through a swivel nut on the bar. The depth of the cut was regulated by adjusting the boring tool. When finished, the hole was 3 in. diameter. A fairly smooth hole was obtained by taking light cuts.



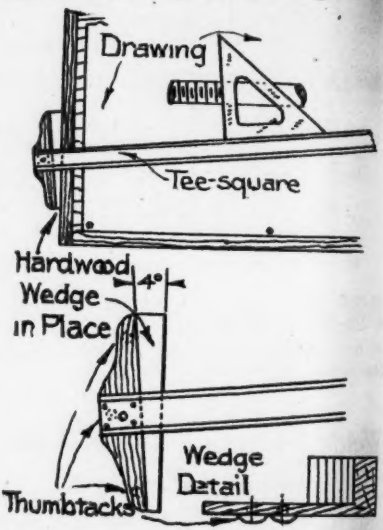
Radial drill rigged up to bore a curved hole.

This job could be handled even more efficiently on a horizontal boring machine, where it would be possible to effect better arrangements to hold the piece steady while the tool was cutting.

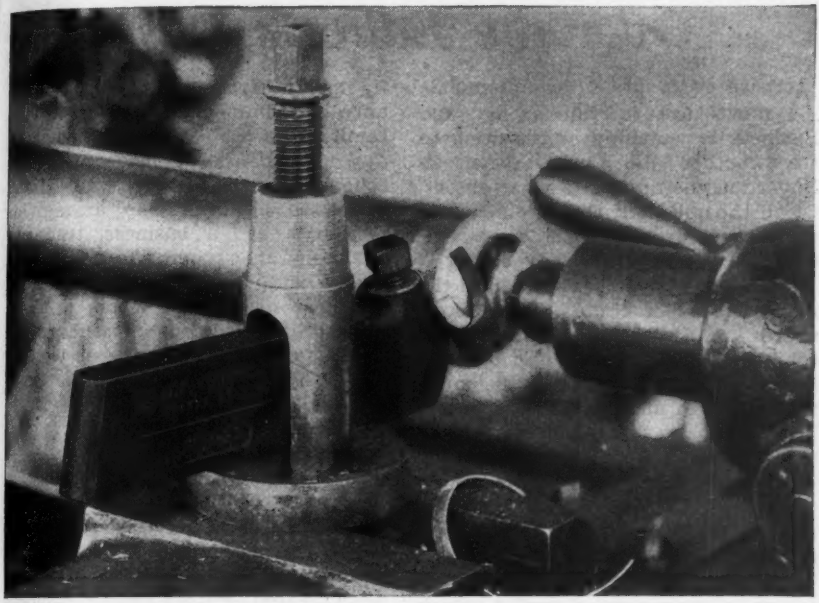
Making Small-Angle Lines with T-Square

By MORRIS A. HALL

WHERE small-angle lines of the same angle are drawn frequently, the ordinary T-square can be adapted for drawing such lines by adding a wedge of the proper angle to the head end. For showing threads of bolts, screws, and so on, a wedge having an angle of 4 deg. will be found convenient. The wedge should be cut from a piece of hardwood about ⅛ in. thicker than the head of the T-square, the angle or bevel part being left full thickness and thinned down as shown in the illustration so that it can be slipped under the head of the square. It should also be drilled through the thin part so that thumb tacks can be inserted. To use, the thin part of the wedge is slipped into place over the head of the square, the tacks inserted to hold it, and the square is then used in the usual manner. As the drawing shows, the square can be used directly, or to give the proper inclination to a triangle.



T-square fitted with wedge for drawing small-angle lines.



BETTER TOOL HOLDERS

Williams' "Agrippa" Tool Holders have earned their reputation as the "Holders that hold" solely upon their superior performance. Accurate broaching of the cutter seat and careful hardening all the way through provides a chatter proof grip even after years of service with short bits. The hardened seat will not become marred or recessed—the commonest cause of cutter breakage.

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Threading-Tool Holder with lockable spring head.

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Right Hand Offset Turning-Tool Holder. Also Straight and L. H. Offset.

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WESTERN WAREHOUSE, SALES OFFICE, CHICAGO. .. WORKS, BUFFALO, N. Y.

Over the Editor's Desk

AS we go to press the automobile shows are in full swing, and Business is watching and waiting to see whether the Great American Buyer loosens up and to what extent. Of all the questions that are asked at the shows probably the most oft-repeated is "How are they selling?"

Automobile sales have replaced the market price of United States Steel shares as a barometer of business conditions. The eyes of the country, if not the world, are upon the automobile shows and everyone is awaiting anxiously the reports of sales made by the various manufacturers.

It is estimated that there are something over 21,000,000 cars now in use, and that an average of 3,000,000 cars must be manufactured each year to take care of replacements alone. That figure is based upon statistics which show that the average life of the average American-made car is seven years. During the last couple of years this figure has gone up, thus swelling the number of sales that will be made when buying is fully resumed. Also, many of the cars of ancient vintage that would have been kept running in better times have been, of necessity, discarded altogether.

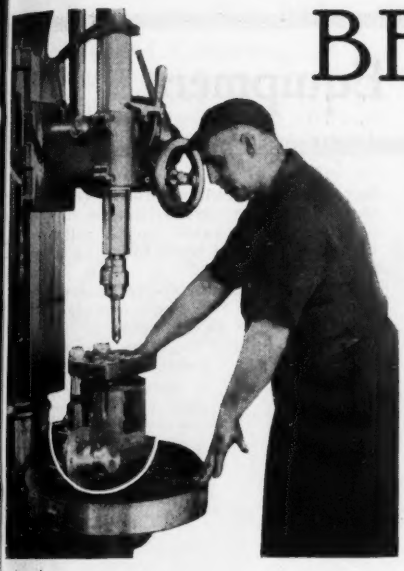
Reports at the moment indicate a fair volume of sales. Sales in other lines seem to be on the increase, and altogether the prospects seem a bit brighter than they have for some time past.

IT augurs well for the future of both the race and the individual that more attention is being paid, in these days, to the selection of tasks for the rising generation.

In our grandfathers' time the matter of launching the youth of the family upon a career was of first importance and immediate concern to the family. As the boy reached what today would be considered "high school" age, the father began looking about to discover who among his neighbors had a business, trade, or profession that might afford an opportunity, and who might also be a good and just man under whom to serve an apprenticeship. Conferences were held and, if everything went well, in due time the boy was properly indentured and started on the way to absorbing the knowledge and experience necessary for his life-work.

While there are still a number of trades and many plants in which this system still holds, the last several decades have seen the system largely abandoned. So many opportunities were created through the development of mechanical devices of all kinds and the expansion of markets through the introduction of high production machinery that the average lad could garner a job, of one kind or another, almost any hour of the day. Whatever the benefits accruing from this state of affairs, it has led many boys into taking up work which, while offering immediate returns considerably above the pay received by a green apprentice, was in no wise commensurate with their potential ability.

Psychologists are now going seriously about the task of finding methods by which the young man on the threshold of life may be aided intelligently to select the work for which his mind is bent, in which he will naturally be interested, and into which he will, as a matter of course, put the best he has. His chance for success will be much greater, his industry or profession will be benefited, and society as a whole will be richer.



BETTER SERVICE

At No Extra Cost!

Whenever you buy a SIEWEK *Rapid Clamping* DRILL JIG .... you are sure of getting better drill jig service *at no extra cost!*

For instance, one of the country's large trailer manufacturers installed the Siewek Rapid Clamping Drill Jig shown in the illustration, completely tooled for drilling four holes in a drop forged steel king pin. Production on this particular operation was tripled by the use of this equipment.

They have now installed more of our jigs on different drilling jobs.

SIEWEK *Rapid Clamping* DRILL JIGS will do the same in your shop. Send us your blue prints and let us show you how they can be adapted to your work. It will pay you.

Write *for a* Catalog

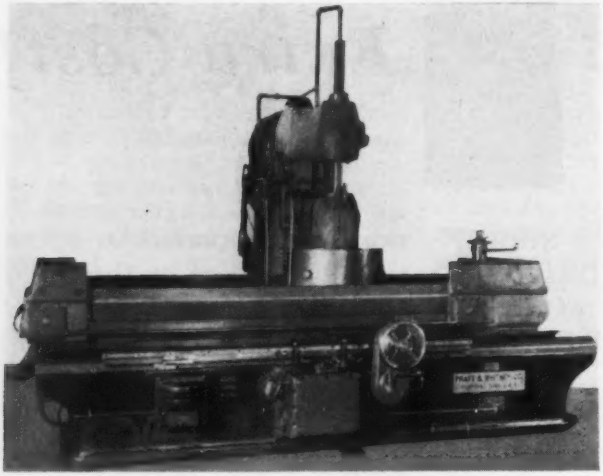
SIEWEK TOOL COMPANY

10232 WOODWARD AVENUE DETROIT, MICHIGAN

New Shop Equipment

P & W 26-In. H. D. Hydraulic Vertical Surface Grinder

A vertical surface grinder with hydraulic table drive, to be known as the P & W 26-In. Heavy Duty Hydraulic Surface Grinder, has been announced by Pratt & Whitney Company, Hartford, Conn. It is of rugged construction, its lines following in general the design of the Pratt & Whitney 22-Inch Vertical Surface Grinder, which it replaces. As shown in the illustration, the bed carries the reciprocating table, at the rear of which is a column carrying the wheel head and spindle driving motor.



P & W 26-In. H. D. Hydraulic Vertical Surface Grinder

The working surface of the table is 18 x 88 in. with a maximum travel of 104 in. The dimension from the table top to a new wheel is 16 in., so there is ample capacity for large work. The hydraulic table drive mechanism with its 10 h.p. motor is at the back of the bed, but all controls are in front. Table speeds range from 30 to 175 ft. per min., providing higher grinding speeds than have been available before. In addition, the hydraulic drive makes instantly available any table speed within this range, controlled by a lever on a graduated speed chart.

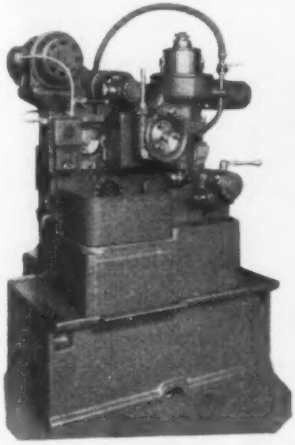
The length of stroke is determined by table dogs of the rack and pawl type. The table can be reversed at any time by hand. Safety dogs are provided. The front table water guard is operated by a lever and can be raised or lowered quickly. A graduated wheel dresser is mounted on the end table guard, available when wanted.

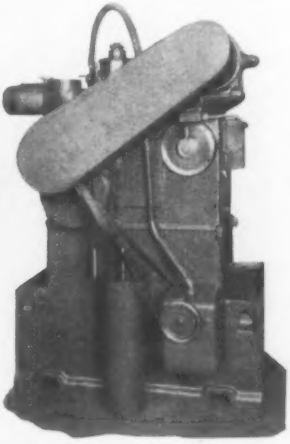
The spindle, which is mounted in anti-friction bearings, is driven through spiral bevel gears by a 75 h.p. 1150 r.p.m. constant speed motor, producing a spindle speed of 750 r.p.m. The wheel spindle is very rugged, with a large flange forged on its lower end to which the wheel chuck is directly attached. The down feed to the wheel head is regulated by a graduated shield over the wheel feed ratchet, the total amount of feed being set by a graduated dial on the wheel feed handwheel. Power feeds (hydraulic) range from 0.00025 in. to 0.005 inch.

A segmental-type wheel is used, making it possible to use harder segments without appreciable increase in cost. The segments can be adjusted or removed easily. Coolant is supplied from a 350-gal. tank through a pump driven by a separate 2 h.p. motor. The coolant is sent through the wheel spindle and also through a pipe line to the outside of the wheel. All three motors are controlled by a push button station located at the front of the machine. The machine is regularly furnished arranged for motor drive only.

Fellows "Hourglass-Type" Worm Thread Generator

The Fellows Gear Shaper Company, Springfield, Vt., has placed on the market a thread generating machine that is particularly adapted for the cutting of so-called "hourglass-type" worms. This type of worm usually operates with a helical gear segment, as shown in the illustration, or a rack-tooth shaped cylindrical roller. The mating helical tooth segment can be generated on the high speed gear shaper.





(Left)—Front view of Fellows "Hourglass-Type" Worm Thread Generator. (Center) — Hourglass worm and helical-tooth sector used in automobile steering gears. (Right)—Rear view of generator, illustrating motor drive.

The machine possesses several noteworthy features; owing to the almost ideal cutting action obtained, it provides a very rapid method of cutting this type of worm. It is said that a single-thread hourglass worm of 4.268 D. P., using a 13-tooth, 3.046-in. pitch cutter, can be completed in 2 min. or less, floor to floor, the actual cutting time being 45 sec. for roughing and the same for finishing.

The outstanding feature of the machine, aside from its high production possibilities, is the side-trimming mechanism. This feature provides positive control over thread proportions, in that with work and cutter set at standard center distance, the cutter can be oscillated the required amount each side of central position to cut the thread to the desired proportions.

In operation, the work is retained on an arbor held at one end by the work-spindle and supported at the other end by a female "live center." The cutter is presented in a position at right angles to the work, and is gradually fed to the required depth by a feed cam as work and cutter are rotating in mesh with each other. There is no lateral motion to the work, but the cutter, especially for finishing, oscillates at the same time as it is being fed in.

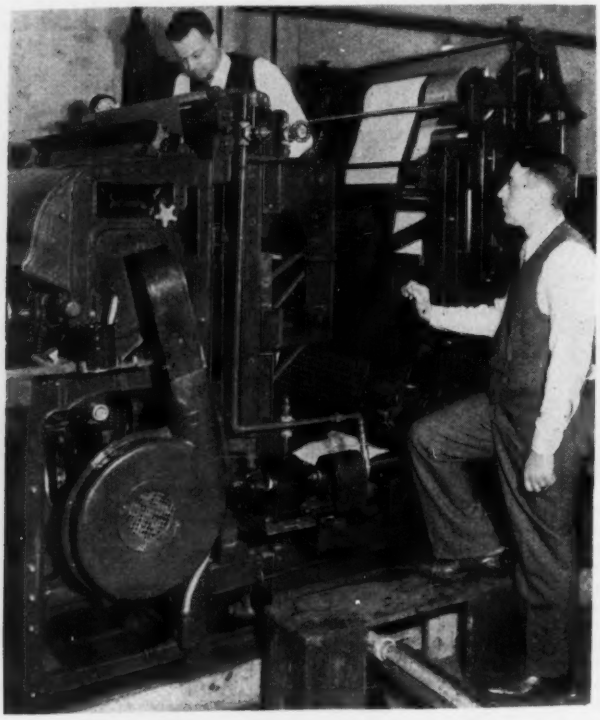
The cutter-spindle is made adjustable for height so that the lower face of the cutter can be set in correct relation to the axis of the work. The adjusting means comprises a micrometer graduated nut and locking nut threaded onto the upper end of the cutter-spindle. The amount of side trim can be varied by adjusting the "throw" of the cam through a micrometer collar graduated in 0.001 in.

The work always rotates in clockwise direction, but provision is made through a sliding sleeve and spiral bevel gears to change the direction of rotation of the cutter for cutting right-and-left hand threads. The rear view of the machine shows how power is applied through a 3 h.p. constant-speed motor. Electric push button control is provided, which automatically stops the machine when the cut is finished.

"Kyano" Process For Developing Blue-Prints and Blue-Line Prints

The C. F. Pease Company, 815 N. Franklin St., Chicago, Ill., has developed a process of blue-printing by which the operator is enabled at any time to make blue-prints along with blue-line prints, either side by side or in succession, at the same speed. The new proc-

ess is called "Kyano," from the Greek word meaning "dark blue," which is a characteristic of the prints that are produced with this machine. A feature of the process is the fine line of demarcation between the blues and the whites, giving a sharpness of detail that has been impossible with the usual method of blue-printing.



Pease Blue-Printing Machine with "Kyano" Attachment.

The equipment necessary to make blue-prints and blue-line prints by the "Kyano" process consists of the Pease "Kyano" process attachment and "Kyano" chemical, which comes in a dry-pulverized form. The attachment is designed exclusively to operate on Pease blue-printing machines, particularly the newer type Pease "Peerless" Model 30 and Model 25 continuous blue-printing equipments. It can also be adapted to operate on the older types of Pease machines, Model 20 and Model 10, which constitute the majority of blue-printing machines now in operation.

After the "Kyano" chemical solution has been prepared according to directions, it is poured into the copper supply tank. The paper is then threaded through the "Kyano" process attachment and the equipment is ready for operation. Tracings and negatives are fed into the blue-printing machine in the regular manner. Just before the paper enters the developer, it passes between two stainless steel rolls that revolve in the "Kyano" solution and thus apply the solution to the paper the second time. The double application of "Kyano" solution to the paper results in a background of deep blue with lines of clear white, as sharp and clear as the lines on the original tracing. After the surplus chemical has been washed from the paper as it passes through a spray jet wash, the paper is ready for drying. The use of potash can be dispensed with entirely.

The Kyano process produces with fast printing papers a deep, rich, brilliant blue that has heretofore been possible only with slow printing papers. When using a fast printing paper, it was impossible to secure a good blue color and attempts to improve the color by longer exposure usually resulted in a background of slate color with the lines tinged with blue, or in the lines being "burned out" completely. With the new process, the deepest blues and clearest whites are apparently obtained by over-exposure. Spoiled prints are unlikely. As a matter of fact, the Kyano process in combination with fast printing papers in continuous operation produces work of finest quality at a good rate of speed.

An added feature of the Kyano process lies in that it provides a much greater range of printing speeds than have been possible before, and is less dependent upon the human element in exercise of judgment. It is not necessary to hit the exact printing speed of a tracing or negative in order to obtain a satisfactory

print, and in some cases the range of printing speeds will run from 5 to 6 points on the controller.

The Pease Kyano process attachment is shipped completely assembled and installation on any Pease continuous machine can be made in a short time. The attachment is mounted directly at the rear of the machine before the first water wash, and ordinarily only one plumbing connection is required. The capacity of the solution tank is 10 gallons and when preparing solution for operation, the one day's supply only is made up.

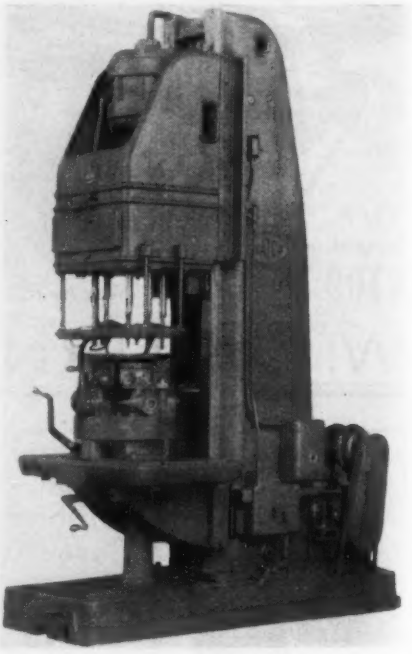
Natco Model B14H Hydraulic Drilling Machine

Increased production and lower operating costs are claimed for the Natco Model B14H Hydraulic Drilling Machine recently developed by the National Automatic Tool Co., Richmond, Ind. The machine is especially designed for fixed-center drilling. The various cluster boxes may be changed to suit the individual job, which arrangement makes the B14H unusually flexible for a machine of this type and adaptable to a wide range of work.

The hydraulic feeding pressure is supplied by a high pressure volumetric pump. The control is centralized, the machine being operated by a single foot treadle within easy reach of the right foot, leaving the operator's hands free to handle the work. The ways on which the slide travels are 18 in. wide from right to left and 1¾ in. thick, with a bearing surface of 3½ in. on each side. Wear on the ways is compensated for by an adjustable gib. A standard Natco motor housing is mounted on the upper portion of the slide, allowing the necessary space on the lower portion for mounting cluster boxes.

The box design of the column resists deflection under thrust loads that are imposed by heavy feeding pressures. The table is of the adjustable knee type, gibbed in the same manner as the slide. The minimum height of the working surface above the floor line is 22 in., and the total adjustment is 17¼ in. The area of the working surface is 23 in. from front to back by 40 in. from right to left. T-slots are provided for clamping, and there is a channel for coolant around the edge of the table. The base is of gridiron T-section construction, with a finished working surface 22 x 32 in.

Oil is used in the hydraulic system, feed being supplied by an Oilgear QS pump having a pressure of 1,000 lb. per sq. in. The high pressure pump is utilized at its maximum capacity for rapid traverse, the rate being increased by means of a differential control system. An oil reservoir, cast as a separate part of the machine, is mounted on the base at the rear of the column. The Oilgear pump is mounted in the side of this reservoir and driven through two wel-



Natco Model B14H Hydraulic Drilling Machine

guarded V-belts by a 3 h.p. motor which is mounted on a bracket on top of the reservoir. The motor bracket is made adjustable to take up slack in the driving belts.

The motions of the head are controlled by a sliding valve with a rapid forward, feed, reverse, and stop. The movements of the valve are controlled by a trip mechanism of the load and fire type, linked up with a foot treadle at the front of the base. The trip mechanism works with precision under heavy operating conditions. The machine is started by depressing the foot treadle, the travel of the head and automatic cycle starting

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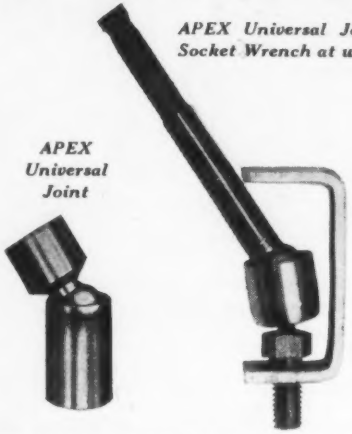

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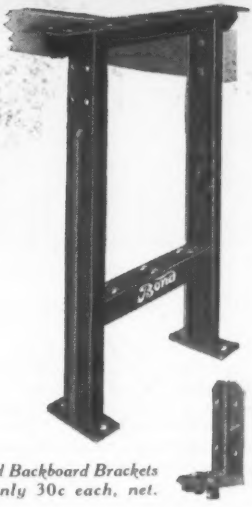

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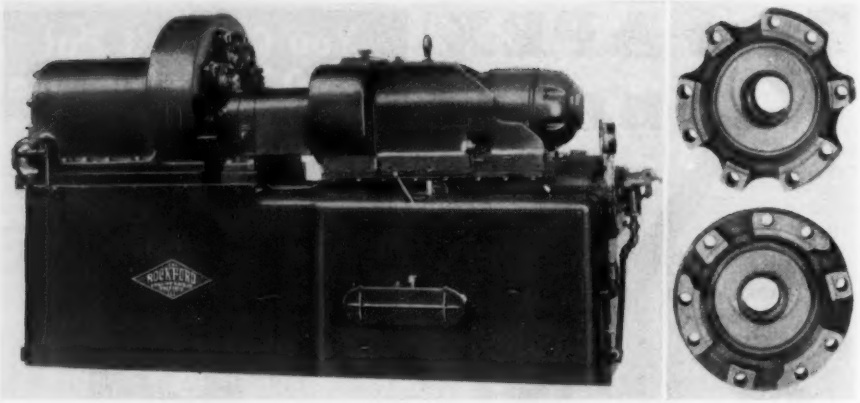
The *new* BOND Steel Bench Leg—costing only $5.40 a pair and so entirely useful in your plant they'll put the price back in your pocket ten minutes after they're in use. Here are a few reasons why you should order several sets—Designed with box formation for strength—Ribbed for additional strength—Perpendicular legs for easier working—Flat top section (board or steel easily and securely bolted)—Formed angle cross sections—All electrically welded—no rivets. The *new* BOND Steel Leg is priced right—you couldn't build them of crating lumber as cheaply—so send your check ($5.40 a pair at the factory) for one pair or as many as you can use. ***If you prefer, just tear out this advertisement, write your name, address and number of sets you wish on the margin. We'll send you the bench legs and a bill for them.***

Bond Foundry & Machine Co.

Manheim, Lanc. Co., Pa.



(Left)—Rockford Automatic Burnishing and Grooving Machine.
(Right)—Work-pieces after burnishing and grooving.

when the foot treadle is released. The forward motion of the head may be stopped at any point by depressing the treadle the second time. The complete control is enclosed in one housing, where all parts are easily accessible.

Adjustable trip dogs are fitted in T-slots at the rear of the slide for setting the length and position of feeds. Adjustment of the feeding rates is made by means of a calibrated device on the pump itself. All motors are operated simultaneously by a remote control system operated from a push button.

The machine is furnished with or without a coolant system, as ordered. The coolant pump is a ten-gallon gusher-type pump with direct-connected motor, the unit being mounted on the rear of the base over the coolant reservoir.

Rockford Automatic Burnishing and Grooving Machine

An unique and cost-reducing adaptation of the equipment made by the Rockford Drilling Machine Co., 10 Catherine Street, Rockford, Ill., is shown in the accompanying illustrations of the machine and the parts worked on. The feature of the machine is the automatic operation of both the machine head and the indexing drum fixture, reducing the operator's duty to merely that of loading and unloading parts. The speed of the machine is adjusted to the ability of the operator. The operation consists of burnishing the face around the bore of the piece and cutting a groove in this face.

Two parts at a time are loaded and unloaded at the idle stations, of which there are two for the convenience of the operator. While this is taking place, two parts at the first working station have the oil groove cut in them and two parts at the second working station, previously grooved, are burnished. The machine head feeds forward at the correct rate, cuts the groove, builds up pressure for the burnishing operation, and then returns to starting position. At the same time the fixture drum automatically indexes one station, locates itself accurately, and the cycle is repeated. The machine continues to function in this manner until stopped.

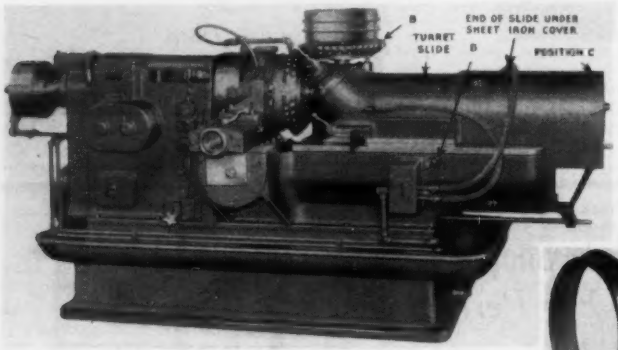
A seven-second cycle is possible, although this may be slowed down. All functions of feed and indexing of the drum are obtained through the operation of an Oilgear hydraulic pump. All parts of the machine, including the ways and guide bushings, are automatically lubricated.

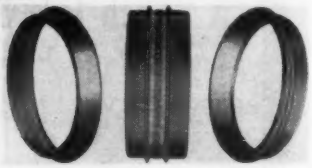
A 7½ h.p. motor drives into the machine head through proper gearing to the spindles. Four spindles are incorporated for the operations noted above, mounted in Timken Tapered Roller Bearings, and all working parts in the head are lubricated by an oil bath. The special grooving and burnishing tools are guided accurately by bushings carried in a separate bracket mounted on the machine base. The indexing fixture drum is also mounted in large Timken bearings and is operated hydraulically, locating itself accurately at each station.

Guards are provided wherever necessary, and the machine can be stopped at any point in the cycle. The machine is available in various sizes and arrangements.

Sundstrand Brake Drum Splitting Machine

Among the more recently developed methods of manufacturing automotive brake drums is that of cutting the material for the shell to length, rolling it to shape, and then electrically welding it, after which the lining is centrifugally cast into the shell. It is then parted, making two drums. To simplify the parting operation the Sundstrand Machine Tool Co., Rockford, Ill., has brought out the machine shown in the illustration.





Sundstrand Machine for Splitting Rolled and Welded Steel Brake Drums. (Right)—Drum Before and After Splitting.

To operate, the operator places the assembly, consisting of two drums, on the loading platform and the work carrier "B." He then turns the carrier by means of a knurled ring which operates a three-jaw scroll chuck, gripping the piece lightly from the inside so that after the parting tools have completely split the assembly into two parts, both parts are held securely, eliminating any possibility of tool breakage.

The machine is shown with the slides in the forward position, the drum having been split. The slides then automatically return on rapid traverse to loading position. The movement of the slides automatically releases the air and causes the chuck to open, the movement of the chuck draw rod operating a limit switch and causing the spindle to stop. When the cut-off slides are fully returned, valve "D" is automatically operated, causing the turret slide to return to position "C," at which position turret "B" automatically indexes 180 degrees, bringing the two halves to unloading position and the assembly to chucking position. The operator again turns valve "D," causing the turret slide to approach and automatically place the assembly into the chuck jaws, in which it is automatically clamped. He then presses a button, starting the cycle of operation.

It is interesting to note that the work-holding device on the loading turret revolves with the spindle gripping the part lightly on the inside by using spring-loaded jaws in order that the chuck which grips the part from the outside may compensate the work. The inside jaws hold the work after the cut-off operation has been completed so that the two halves may be returned to unloading position and so that tool breakage may be kept to the minimum.

Four "J"-metal tools are used for the cutting-off operation — two in the rear slide and two in the front. In each case one tool is mounted directly over but slightly in advance of the other.

Bridgeport No. 48 High Speed Cut-Off Machine

The Bridgeport Safety Emery Wheel Co., Inc., Bridgeport, Conn., has brought out the No. 48 High Speed Cut-Off Machine shown in the illustration. The machine is said to be especially fast on the cutting of light sections, will cut hard or tough metals or alloys quickly and without heating, and is particularly well adapted for the cutting of non-ferrous metals.

The cutting is done by means of a

Bridgeport No. 48 High Speed Cut-Off Machine.

disc, mounted in a rocking head that is balanced by the motor, both units being mounted on a rocker shaft that operates on Timken bearings. The bearings are fully sealed against dust or grit. A 7½ h.p. motor is used, running at 3,600 r.p.m. The disc spindle runs at 5,200 r.p.m., producing a wheel speed of 16,000 ft. per min. Power is transmitted from the motor to the disc by six strands of ½x$\frac{13}{32}$-in. V-belt of standard make. The motor may be rocked separately on the rocker shaft to slacken the belt for changing or taking up.

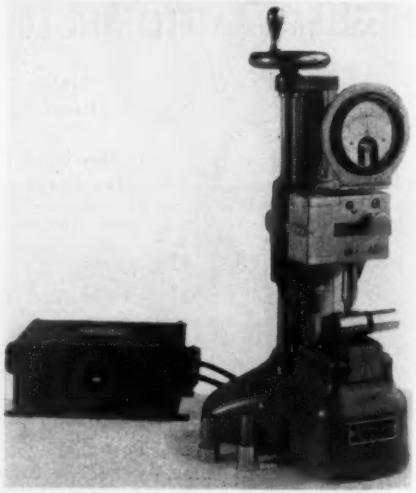
The standard vise takes sections up to 2½ in., cutting either straight or at angles up to 45 deg. The vise swivels on the table and may be set at any angle or may be quickly removed and substituted by other holding arrangements. Adjustment is provided for the vise, the clamping action being obtained by a draw rod and foot treadle.

The table is large, as shown, and is bolted on separately, permitting substitution of special tables or fixtures when required. The machine is regularly furnished for 12x$\frac{5}{32}$x1-in. discs, but can be equipped for 14-in. or 16-in. discs. The wheel guard will withstand, with ample factor of safety, the impact of a bursting wheel. The V-belt is also fully guarded. All bearings are grease-lubricated, fully sealed against dirt. The swing of the head is limited by the hand knobs at the front and rear of the machine.

P. & W. Electrolimit Gage

The illustration shows a new adaptation of the Electrolimit Gage which has been introduced by Pratt & Whitney Company, Hartford, Conn., in the form of a comparator for external gaging. This instrument provides a fast and accurate means for the inspection of production work and will prove valuable in "selective inspection" which has become general practice in many industries. The comparator has a capacity of 4 inches.

The comparator comprises a base of fine grain cast iron, carrying an anvil and a column. The anvil has a corrugated surface 1½x3½ in., and is made of hardened steel, chromium plated. As shown in the illustration, there is an adjustable backstop to facilitate the gaging of cylindrical parts. The anvil can be removed easily, and the reverse provides a V-block. If desired, any special



Pratt & Whitney Electrolimit Gage.

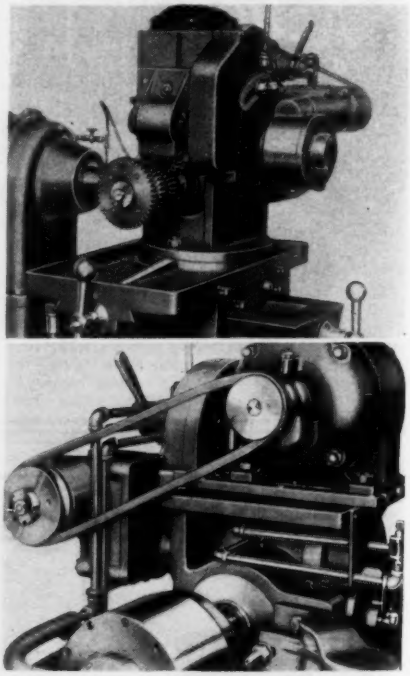
arrangement of anvil can be substituted for particular jobs. The column that carries the gaging head is a heavy chromium-plated hollow steel cylinder of great rigidity, anchored in the base.

The electrical power unit is contained in the enamelled metal box at the left in the illustration, the size of which is 5x4x8 in. This is the only equipment necessary to plug in on a 110-volt, 60-cycle line. A transformer in the unit reduces the current to 10 volts, which is all that is required. A voltage regulator practically eliminates inaccuracies due to voltage fluctuations.

The DO-14 micro-ammeter mounted on the gaging head has a 2¼-in. scale. The standard magnification of the circuit will cause the needle to travel about $\frac{7}{16}$ in. for each 0.0001 in. variation in the sizes of the parts gaged. Magnification can be increased or decreased as desired to suit conditions. A chromium plated anvil, tungsten carbide or diamond gaging contact point, and the complete elimination of bearings, gears, pinions, racks, and so on, assure continuous accuracy. The maximum and minimum setting plugs with which the gage is calibrated for checking the piston pin shown in the gage in the illustration are also shown at the left of the gage.

C. M. & T. Work-Head Drive for No. 3 Peerless Chamfering Machine

As an optional feature at a slight additional cost, the City Machine & Tool



(Above)—Work head on No. 3 Peerless Chamfering Machine with V-belt drive. (Below)—Rear view of motor and gear reduction unit.

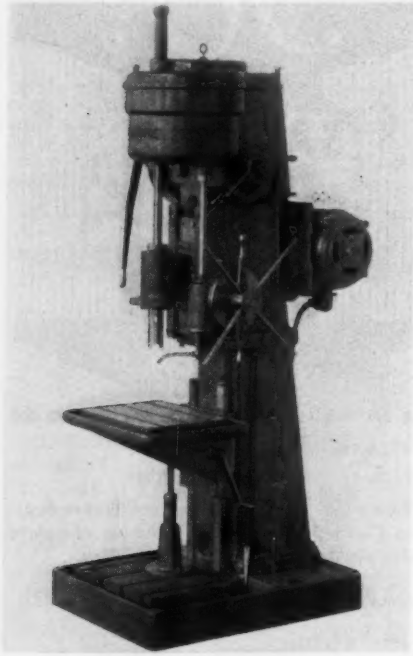
Works, East Third at June Streets, Dayton, Ohio, is offering a belt drive for the work head of the No. 3 Peerless Chamfering Machine. Instead of utilizing a combination geared-head reduction motor, this drive separates the reduction unit and the motor and permits the use of a standard motor which drives the reduction unit by means of "V" belts. An additional advantage is provided in that the operating speed of the work head can be changed to secure maximum results for each individual type of operation, rather than setting the machine work head to a given operating speed.

The drive was developed to meet the need of manufacturers who desire to use

standard motors only, but where the advantage of flexibility in change of feeds and speeds is required. The illustration shows a view of the work head set up to chamfer the small gear on a cluster, together with a rear view of the motor and gear reduction unit.

Defiance No. 112 Production Drill

The Defiance Machine Works, Defiance, Ohio, has brought out the No. 112 Production Drill shown in the illustration. This machine is intended for continuous operation in a production line and is designed as a single purpose machine, yet has the flexibility of a general purpose machine when it becomes necessary to change the speed or feed. By transposition of gears, any one of 16 speeds or 16 feeds are available.



Defiance No. 112 Production Drill

The driving clutches, both forward and for reverse when tapping, are mounted on the main drive shaft and are of the multiple disc type. The clutch discs and driving cups are of hardened steel and run in oil, assuring long life. The clutches are mounted between the bevel drive gears which are mounted in large ball bearings and in their hubs carry Hyatt roller bearings for mounting the drive shaft.

The drive is transmitted directly to the spindle with only three gear contacts necessary at any time between the drive shaft and the spindle drive sleeve. The shafts and sleeves are mounted vertically in large ball bearings and have their upper ends splined to receive the speed gear train. The train consists of four double gears, multiple-splined to fit interchangeably on the sleeves and shafts. The speeds possible vary from 263 to 1,234 r.p.m. A similar arrangement of four double gears with splined holes to fit interchangeably on the upper ends of four vertical splined shafts comprise the feed train, making possible a selection of 16 feeds from 0.004 to 0.025 in. per revolution of the spindle. Special gears can be supplied to increase or decrease the above speeds or feeds.

The spindle passes through the drive sleeve, which it is splined to fit, and rotates in Timken tapered roller bearings mounted near the nose in a housing that is attached to a slide which carries the feed rack. Multiple spindle heads may be attached to the lower side of the spindle bearing housing by means of a flange or lugs to the head, or they may be made to bolt onto the slide, in which case a multiple splined shaft would serve to drive it instead of the spindle.

The feed to the spindle slide is obtained through a rack attached to the rear side and a pinion cut integral with the feed clutch shaft. The feed clutch is of the integral expanding friction type, with ample power. It is engaged by a short forward movement of the knockout lever and is disengaged automatically at a predetermined depth of drilling.

The cutting lubricant pump is driven by the main shaft drive and is arranged with a clutch for disengagement. The table is furnished with either a jack screw or pedestal blocks for vertical adjustment. One set of blocks provides 15 in. of vertical adjustment with variations of 1 in. The top of the table has standard T-slots and is surrounded with a water trough. The base is provided with T-slots and is surrounded with a water groove.

The total height of the machine is 8 ft. 1½ in. Floor space required (belt

driven), 2 ft. 9 in. x 3 ft. 8 in.; (motor driven), 2 ft. x 4 ft. 3 in. Working surface of table, 16 x 20 in. Maximum dimensions, spindle nose to top of table, 32½ in. Vertical adjustment of table by jack, 18½ in. Distance, center of spindle to column face, 10½ in. Spindle travel, 12½ in. Number of spindle positions on slide, 3. Morse taper in spindle, No. 4. H.P. of constant speed motor to drive, 3 or 5. Net weight, belt driven, 3,100 lb. Motor driven, 3,300 lb.

Dwarf Brinell Press

A hardness testing instrument of unique design and small enough so that it may easily be carried about the plant for making tests on large work has been

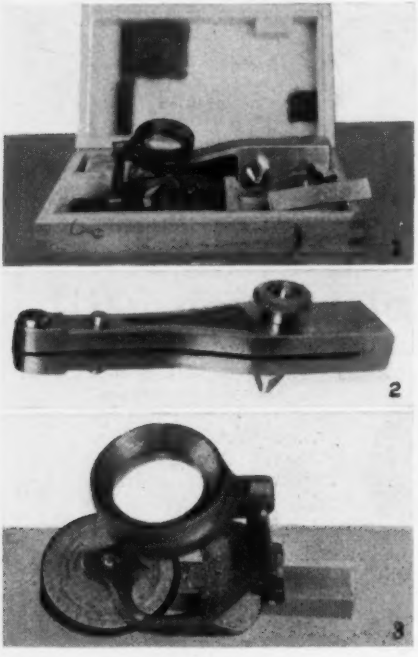


Fig. 1—"Dwarf" Brinell Press Outfit. Fig. 2—Dwarf Brinell Hardness Tester. Fig. 3—Evolute Loop for reading diameters and Brinell Numbers.

placed on the market by The R. Y. Ferner Co., Investment Bldg., Washington, D. C. The instrument is designated as a "Dwarf" Brinell Press, due to the fact that the design is based on the Brinell principle of making an impression in the metal to be tested by applying a known load to a steel ball of a given diameter.

The instrument consists mainly of a heavy steel section approximately 7¼ in. long, ⅞ in. thick, 1⅝ in. wide at one end, and tapering to a width of ¾ in. at the other end. This piece is slit in the horizontal plane from the smaller end to within ¾ in. from the larger end to form a heavy two-pronged spring.

On the under side of the piece, near the end of the slit, is mounted a holder for the steel ball. The ball is 5 mm. diameter. Opposite, on the upper prong, is a knurled knob to which the pressure is applied. To make a test, the instrument is held in a drill press or between the jaws of a vise or C-clamp with the ball point against the piece to be tested. Pressure is then applied for 30 seconds after the full load is reached, in the same manner as in the bench types of Brinell presses. The pressure used, however, is only 750 kilograms, which is the correct pressure for use with a 5 mm. ball, since the pressure should vary as the square of the diameter of the ball to give the same Brinell numbers as the larger instruments.

The measurement of the pressure is determined by the sense of touch. A $\frac{5}{16}$-in. pin in the lower prong at the small end of the instrument extends upward through a hole in the upper prong to a point, when no load is being applied, about 1 mm. below the surface. When pressure is being applied, the user grasps the small end of the instrument with his thumb or a finger over the end of the hole, and when he feels the end of the pin to be flush with the surface, he knows that the full pressure of 750 kilograms has been applied. This method is said to be accurate within 1 per cent.

The pressure is released after the usual 30-second period, and the impression is ready to be measured. The measurement is taken with an instrument called an "evolute loop," consisting of a magnifying glass equipped with a cam having a rim with an evolute curve. The magnifying glass is mounted on a hinged arm that is connected to a base having a beveled edge which serves as a reference mark or index to be placed in contact with one edge of the Brinell impression. The cam is then rotated until its edge makes contact with the opposite edge of the impression. By means of a scale attached to the cam and a suitable index, the diameter of the impression can be read directly, in twentieths of a millimeter with estimates to hundredths. The

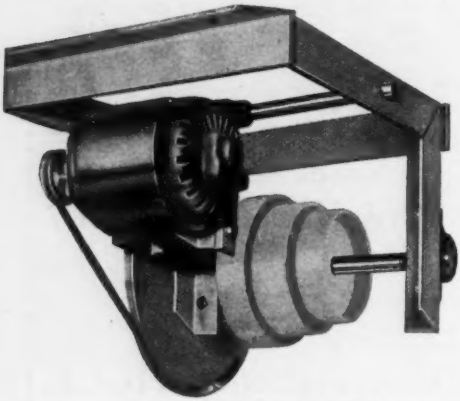
dial also shows the Brinell number, and, for tests of steel, a scale of the tensile strength, the latter being based on the relation of tensile strength to Brinell numbers.

The outfit is supplied in a polished wood box, 8½ x 5 x 2 in., and weighs only 3 lb. 9 ounces.

Furnas Electric Power Unit

Individual motor drive can now be applied to any machine tool at a comparatively low cost by the use of the Furnas Electric Power Unit, shown in the illustration. This unit, which is being marketed by W. C. Furnas, 1523 South 77th Street, West Allis, Wis., consists of a steel frame, an electric motor, a Texdrive reduction to the pulley shaft, and suitable electrical control for the particular conditions under which it is to operate.

The unit is compactly built and can easily be installed in any position. It is built in standard sizes from ¼ to 10 h. p., with shafts in sizes from ¾ in. up, advancing by sixteenths of an inch. Approximately twenty different speeds can be obtained, ranging from 200 to 600 r.p.m. Adjustment of the Texdrive belt is quickly and easily made when necessary. The frame is electrically welded,

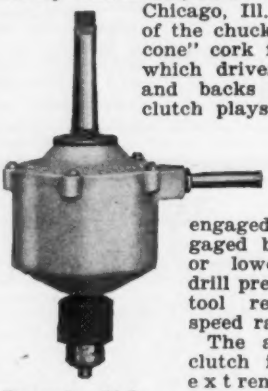


Furnas Electric Power Unit

and the sheaves are of pressed steel construction. Either A. C. or D. C. motor may be used, with electric control which may be manual or automatic, either reversing or non-reversing. The unit is furnished complete with motor and control.

Procunier ¼-In. High Speed Tapping Attachment

A super-sensitive, high speed tapping attachment of ¼-in. capacity, capable of tapping holes at a speed of 3,000 r.p.m., has been developed by the Procunier Safety Chuck Co., 18 S. Clinton Street, Chicago, Ill. The feature of the chuck is a "double-cone" cork friction clutch which drives the tap in and backs it out. The clutch plays between two driving shells, rotating in opposite directions, and is engaged or disengaged by the raising or lowering of the drill press lever. The tool reverses at a speed ratio of 2 to 1.



Procunier ¼-In. High Speed Tapping Attachment.

The action of the clutch is said to be extremely smooth. All jar and clatter are said to be eliminated by the cushion-like action of the cork clutch, and the tap slips instantly if it strikes bottom or sticks in the hole. Ball bearing mountings and three-point balanced all-hardened gear reversing mechanism provide durability under heavy duty. The tapper is particularly effective on delicate tapping jobs up to ⅛-in. diameter in steel and ¼ in. in brass.

Building the Hamilton Watch

(*Continued from page* 18)

is held in position. A slot in the wedge provides clearance for the saw. The saw is 0.006 in. thick and operates at a speed of 3,000 r.p.m. Hand feed is used. The width of the slot is held to a limit of 0.001 in., as determined by the use of a spring steel "Go-and-No-Go" gage.

(The third article of this series will be published in the March issue of Modern Machine Shop.)

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Pointers on Internal Grinding: A folder containing data on the selection of internal grinding spindles, selection of grinding wheels, methods of holding work, grinding bushings, grinding holes with keyways or slots, and other useful information will be sent free to any machine shop executive. Address Abrasive Company, Tacony and Fraley Streets, Philadelphia, Penna.

Ames Gages: Catalog No. 50, issued by the B. C. Ames Company, Waltham, Mass., contains complete descriptions and illustrations of the dial gages, gage heads, upright gages, cylinder gages, dial micrometers, and precision verifiers, special gages and attachments made by this company. Copy free upon request.

Scraping By Power: Bearing surfaces can now be scraped with a power scraper that is quicker and easier than the old-fashioned hand method. The tool is described in a folder that is issued by Anderson Bros. Mfg. Co., 1926 Kishwaukee St., Rockford, Ill. Sent free on request.

Steel Furniture for the Shop: The complete line of steel furniture made by the Angle Steel Stool Co., Plainwell, Michigan, including steel stools and chairs, steel foremen's desks, lockers, tables, tool stands, machine tenders, shop boxes and pans, iron bar racks, trucks, bench legs, and bench drawers, is described and illustrated in Catalog "C," which is issued free to machine shop executives.

Stop Tap Breakage: A booklet that tells how to stop the breakage of taps, reamers, and other tools, by the use of a friction chuck, also how to use the chuck for setting studs or nuts, has been issued by The Apex Machine & Tool Co., 200 Davis Avenue, Dayton, Ohio. Sent free upon request.

Machine Shop Accessories: Catalog B-27, issued by the Armstrong Bros. Tool Co., 328 N. Francisco Ave., Chicago, Ill., describes the line of tool holders, boring tools, wrenches, pipe tools, ratchet drills, lathe dogs, and other tools manufactured by this company.

Hold Odd-Shaped Pieces Securely: A vise in which odd-shaped work can be held securely without the need of special jaws or fixtures is described in a folder that has been issued by The Avey Drilling Machine Co., P. O. Box 487, Cincinnati, Ohio. Copy free upon request.

Hobs and Milling Cutters: A complete line of milling cutters and hobs for cutting all kinds of gears, splines, sprockets and other forms is described in Catalog G, issued by the Barber-Colman Company, Rockford, Ill. Descriptions and illustrations of the Barber-Colman hobbing machine and hob-sharpening machines are included. Sent free on request.

All-Geared Drilling and Tapping Machines: A catalog describing in detail the various types of all-geared, self-oiling, drilling and tapping machines made by the Barnes Drill Co., 801-851 Chestnut Street, Rockford, Ill., will be sent free upon request.

Greenerd Arbor Presses: Catalog No. 36, issued by the Edwin E. Bartlett Co., Nashua, N. H., describes and illustrates all the various types and sizes of arbor presses made by this firm. Copy free upon request.

Automatic Oiled Die Sets: The automatic oiled die sets, die shoes, punch holders, leader pins, bolster plates, bushings, and other standard die parts made by the E. A. Baumbach Manfg. Co., 1806 S. Kilbourn Ave., Chicago, Ill., are described in Catalog No. 5, which has been issued by that company. Sent free upon request.

Portable Flexible-Shaft Machines: Flexible-shaft machines of the latest design and built for heavy duty service are described in Circular No. 50, issued by The Binghamton Flexible Shaft Co., Maple Avenue, Johnson City, N. Y. Copy free upon request.

How To Sharpen Staggered Tooth Cutters, Helical Milling Cutters, and Two-Lipped End Mills: A series of pamphlets on these subjects can be obtained without charge by addressing the Brown & Sharpe Mfg. Co., Providence, R. I.

Buhr Multiple Drilling Equipment: Increase your production with a mutiple spindle head, fixture, and index table built as a single unit. Write for information to Buhr Machine Tool Co., Davis & Greene Streets, Ann Arbor, Michigan.

Steel Bench Legs: The complete line of steel bench legs made by the Bond Foundry & Machine Co., Manheim, Lancaster Co., Pennsylvania, is described and illustrated in a folder that will be sent upon request.

Mounted Grinding Wheels for use in small holes such as are found in bushings, dies, gears, tools, etc., are described in a catalog that has been issued by the Chicago Wheel & Manfg. Co., 110 S. Aberdeen St., Chicago, Ill. Copy free upon request.

Abrasives: Samples of "Aloxite" Brand "TP" Polishing Grains for trial may be had without charge by addressing the Carborundum Co., Aloxite Division, Niagara Falls, N. Y.

Motorize Your Cone Pulley Lathes: An attachment that can be applied to your lathe with four bolts makes it possible to motorize and modernize your lathes. Write for information to Cullman Wheel Co., 1336 Altgeld St., Chicago, Ill.

Flexible Couplings in which there are no screws, no bolts, no grease, no projections, and which run as smooth as a pulley are described in Bulletin 103-B, which can be had by addressing The Clark Controller Co., 1146 East 152nd Street, Cleveland, Ohio.

Gears Of All Kinds are described and illustrated, with specifications, in Catalog 80, which has been issued by the Chicago Gear Works, 105-9 S. Jefferson St., Chicago, Ill.

Grinding Wheel Dressers: All of the different types of grinding wheel dressers made by the Desmond-Stephan Mfg. Co., Urbana, Ohio, including Desmond-Huntington, Desmond-Sherman, Zig-Zag, Diamo-Carbo, and diamond dressers, are described and illustrated in a catalog that has been published by the firm mentioned. Free upon request.

Interchangeable High Production Tools: Catalog No. 28, issued free by the Eclipse Counterbore Co., 7410 St. Aubin St., Detroit, Mich., describes and illustrates the interchangeable counterbores, spot facers, end form cutters, and other end cutting tools made by this firm.

"Speed" Spot Welders for welding metals from 0.0005 in. to 5/8 in. thick are described in a catalog that can be had by addressing Eisler Electric Corp., 761 South 13th Street, Newark, N. J.

Precision Measuring Instruments: The latest types and models of dial indicators, thread lead test gages, pitch gages, thickness gages, dial comparators, and other precision measuring instruments marketed by the Federal Products Corporation, Providence, R. I., are described and illustrated in a book that will be sent free upon application to this firm.

The Involute Gear Simply Explained: A direct, clear explanation of the theory and principles of involute gearing without the use of higher mathematics can be obtained without charge by addressing The Fellows Gear Shaper Co., 78 River St., Springfield, Vt.

The Bearing Metal You Have Been Looking For: Information as to the results that have been achieved by others who have used "Sabeco" bearing metal—the bear-

ing metal with the long life—can be obtained by writing the Fredericksen Company, 841 South Water Street, Saginaw, Michigan.

Motorize Your Machine Tools: A compact, roller bearing electric power unit which can be mounted in any position, in sizes from ¼ to 10 h.p., is described in a bulletin which can be obtained by addressing W. C. Furnas, 1525 South 77th Street, West Allis, Wis.

Questions To Ask Before Buying a Jig-Boring Machine: A list of the fine points to look for in a jig-boring machine, with descriptions and illustrations of the working parts of the Swiss Jig Borer, can be obtained free by addressing The R. Y. Ferner Co., 1511 K St., N. W., Washington, D. C.

Tungsten-Carbide Tipped Tools: The boring tools, counterbores, form cutters, facing heads, reamers, spotfacers, and other tools made by The Gairing Tool Co., 1629 West Lafayette Blvd., Detroit, Mich., made with or without tungsten-carbide tips, are described and illustrated in Catalog No. 20. Copy free upon request.

Adjustable Blade Cutters: Hollow mills, facing tools, face mills, milling cutters and other production tools with adjustable, interchangeable blades are described and illustrated in a booklet that is issued free by the Genesee Manufacturing Co., 141 N. Water St., Rochester, N. Y.

Stampings of any kind or size can be obtained from Gerding Brothers, 5 East Third Street, Cincinnati, Ohio. Write for particulars.

Engraving and Die Sinking Time can be reduced to minimum by the use of a Gorton Universal Die Sinking and Engraving machine, made by George Gorton Machine Co., 1101 13th Street, Racine, Wis. Bulletin free upon request.

Ball and Roller Bearings, either journal or thrust, for all purposes and in all sizes, are described and illustrated in catalog No. 9 which has been issued by The Gwilliam Company, 360 Furman Street, Brooklyn, N. Y. Copy free upon request.

Swiss Files: The complete line of Grobet Swiss Files for use in die and tool work or for other fine work is described and illustrated in Catalog "K," published by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Copy free upon request.

Precision Bench Lathe Work can only be done on finely-built, accurate machines. The complete line of Hjorth Precision Bench Lathes is described and illustrated in a catalog that has been issued by Hjorth Lathe & Tool Company, 60 State Street, Boston, Mass. Copy free upon request.

Tool Room Equipment: Jig borers, vertical shapers, die relieving lathes, tool milling machines, button die grinding machines, and other tool room equipment are described in a catalog issued by the Index Machinery Corporation, 49 Central Ave., Cincinnati, O. Copy free upon request.

Oil and Waterproof Chucks: The J & H Electric Co., 202 Richmond Street, Providence, R. I., is now making a chuck that is oil and waterproof, and is designed to provide a maximum of holding surface with exceptionally strong and uniform pull throughout. Ask for complete information.

Threading Machinery: Catalog No. 32, containing full descriptions of Landis threading machines, stay bolt threading machines, bolt factory threading machines, automatic forming and threading machines and chaser grinders can be had without charge by addressing Landis Machine Co., Inc., Waynesboro, Penna.

Regal Quality in "Regal" Lathes: Forty-two years of lathe-building experience are incorporated in the design and construction of the Regal Lathe—built to offer the highest quality possible at an economical price. Write for details to The R. K. LeBlond Machine Tool Co., 2700 Madison Road, Cincinnati, Ohio.

Air-Operated Work-Holding Devices: A booklet showing how air-operated chucks and devices of various kinds can be applied to different kinds of machines to save time and labor has been issued by The Logansport Machine Co., Logansport, Ind.

Rapid-Reading Micrometer: A new type of rapid-reading micrometer, designed to show the reading in numerals, is described in Catalog No. 5, issued by The Lufkin Rule Co., Saginaw, Michigan. The catalog also contains descriptions of the micrometers, calipers, gauges, scales, squares, bevel protractors, and other tools made by this company. Free upon request.

Save Your Diamonds by using the Diamond Point Angle Tool. Write for information to Mendes Cutting Factories, Inc., Charlevoix Bldg., Detroit, Mich., or 105 West 40th Street, New York, N. Y.

M-C Pinion Rod, made by the Meisselbach-Catanzaro Mfg. Co., 70 Stanton St., Newark, N. J., insures economy and accuracy in cut pinions. Send for information.

Compound Spot-Facing Tool: A spot-facing tool retracting, serrated roughing cutters and fixed finishing cutters in the same tool will break up the scale easily and do accurate work. Write for bulletin to Mummert-Dixon Co., 120 Philadelphia St., Hanover, Penna.

"The Birth of a Notion," published by the National Boring Tool Co., 8619 Mack Avenue, Detroit, Michigan, describes the design, construction, and use of a ball-bearing rotary jig and pilot bushing. Copy free upon request.

"The Answer to Your Gear Problems": Information as to correct methods of cutting and finishing gears will be supplied without charge by The National Tool Co., Cleveland, Ohio. This firm also carries a complete stock of gear shaper cutters and markets the National-Cleveland Spur and Helical Gear Grinding Machine.

Ball and Roller Bearing Data Sheets: A complete set of data sheets showing all the dimensions and loads at given speeds, and giving instructions for mounting precision ball bearing and Hoffmann roller bearings, can be obtained without charge by addressing the Norma-Hoffmann Bearings Corporation, Stamford, Conn.

"Commercial Lapping for Close Limits and High Production" is the title of a booklet that discusses hand and machine lapping, types of lapping tools and machines, workholders for machines, preparation of laps, preparation of work for lapping and other important points. A copy may be had by addressing Norton Company, Worcester, Mass.

Good Vises Breed Good Work: Good bench work is impossible with badly-made or worn-out vises. The seven outstanding features of the Parker Vise are described in a bulletin that can be had by addressing The Charles Parker Co., Meriden, Conn.

"Fastenings" is the title of a booklet, issued by the Parker-Kalon Corporation, 192-196 Varick Street, New York, N. Y., in which are included the results of surveys made in fourteen different plants as to the efficiency of fastening methods. Copy free upon request.

Bunde Offset Boring Heads: Eccentric Boring Heads, precision-made, with a minimum of overhang and a maximum boring range, to fit all standard spindles, are described and illustrated in a circular that can be had by addressing Progessive Tool Co., 419 Hendrie Street, Detroit, Michigan.

Bench Lathe Mounting and Driving Equipment: Bulletin 120-A, issued by Rivett Lathe and Grinder Corporation, Brighton, Mass., contains complete descriptions and illustrations of modern and conventional countershaft, individual motor drive jackshaft, and speed box motor drive, also benches, cabinets, oil pans, etc. Copy free upon request.

Fullmore Industrial Clutch: A multiple disc clutch, made in two types, to run in oil or dry, and which is so built that it can be operated at high speeds, is illustrated and described in a folder that will be sent free by the Rockford Drilling Machine Company, Rockford, Ill.

Automatic Lubrication: Individually motor-driven pumps that keep the work flooded with lubricant are described in a booklet that has been published by the Ruthman Machinery Co., Front and Pike Sts., Cincinnati, Ohio.

Stamp Your Name on Your Product: Full information as to the steel roller dies, embossing dies, and embossing rolls made by the Schwerdtle Stamp Co., 10 Cannon Street, Bridgeport, Conn., can be obtained by writing this firm.

Push-Broaching With Modern Equipment: Modern methods of finishing holes by push-broaching are described in a booklet that is issued free by the Sheldon Machine Co., 3255 Cottage Grove Ave., Chicago, Ill.

Economies in Material Handling: A volume of facts about planned load handling, with actual examples of economies in time, material, and labor costs that have been effected with Shepard electric hoists will be sent free upon request to Shepard-Niles Crane & Hoist Corp., 424 Schuyler Avenue, Montour Falls, N. Y.

Rapid Drill Jigs: How time can be saved and drilling operations made easier by the use of a quick-acting drill jig is told in a booklet that is issued free by the Siewek Tool & Die Co., 10230 Woodward Ave., Detroit, Michigan.

Simonds Files: A useful book on files showing the various styles made, their uses, cross-section, and cuts, and containing a number of reference tables and other information useful in a machine shop can be had by addressing Advertising Dept., Simonds Saw & Steel Co., 470 Main Street, Fitchburg, Mass.

The Most Efficient Speed for the operation of special production units, power conveyors, and other machinery by the use of the WHS Speed Reducer and how it can be obtained is told in a bulletin that will be mailed free by Winfield H. Smith, Inc., 30 Eaton St., Springville, N. Y.

Speed and Accuracy in Straightening: The Springfield Straightening Press is an ideal tool for use in straightening any length or size of rough or finished work. Send for illustrated folder. Address The Springfield Machine Tool Co., 630 West Southern Avenue, Springfield, Ohio.

Rigidmilling Principles and Practice: A book that shows how the Rigidmil can be adapted to various kinds of usual and unusual milling operations, and which describes in detail the work that can be handled by this machine has been issued by the Sundstrand Machine Tool Co., Rockford, Ill. Copy free upon request.

Tips for Torches: Standardized cutting and welding tips that are interchangeable with various types of torches are now available. Write for catalog to Tips, Inc., 515 Cathedral Street, Baltimore, Md.

Chuck With Air: How time and labor can be saved by the use of air-operated chucks, cylinders, and other equipment is told in a book which describes "Hopking" Air-Operated Equipment. Published by The Tomkins-Johnson Company, 620 N. Mechanic St., Jackson, Mich. Sent free upon request.

Change drilling speeds instantly without stopping the machine or touching a belt. This can be done with the Victor Super-Drill, made by U. S. Automatic Box Machinery Co., Newtonville, Boston, Mass. Bulletin free upon request.

Electrically-Driven Portable Tools: The "U. S." line of electric drills, die grinders, electric screw drivers, surface grinders, tool post grinders, and bench and floor grinders is described in Catalog No. 29, which has been published by The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio.

How To Measure Threads with Wires: Circular W26, issued by The Van Keuren Co., Watertown, Mass., tells how to obtain the correct thread pitch diameter with a micrometer and wires. Copy free upon request.

Better and Faster Finishing: Finishing and polishing operations can be performed easier, better, and faster with the Simplex-M Abrasive Band Grinder, marketed by Walls Sales Corp., 96 Warren Street, New York, N. Y. Write for illustrated circular.

Wrenches For Every Use: "Guaranteed Against Breakage" tappet wrenches, pipe and fitting tongs, offset wrenches, and wrenches for all other uses are described and illustrated in a series of folders which can be obtained without charge by addressing J. H. Williams & Co., Buffalo, N. Y.

By GEO. ALEXANDER MANN

Oh Hush

"A cut little pig,
"We call him 'Ink,' " said Ben,
"Because he's always
Runnin' out o' the pen."

If Uncle Sam's money talks it's probably with a foreign accent.

Bobbed hair and short skirts were too sensible to last.

Poor Dora

He said, "The car's dead,"
But Dora didn't tumble,
She said, "The night's nice,
We'll ride home in the rumble."

Then How They Do Drag

Trouble with a lotta guys these days is they're all speed till they get outa their cars.

Whoa

Wife's explanation
To hubby helped a lot,
She stripped the gears
'Cause the engine got hot.

In the ol' days they talked about their crazy quilts. But they never saw our present-day pajamas.

Where you find the "sugar baby" you'll usually find the "sap."

Some Come-Back

"Why didn't you call me
When he kissed you?" mother hissed.
"Why, maw, I didn't know
You wanted to be kissed."

Radio's bringin' back prosperity; headache tablet manufacturers are gettin' rich.

Why — Liz

"Had a pain in my arms
Last night," said Mame.
"And pray," asked Lizzie,
"What was his name?"

The politicians now tell us that prohibition is neither here nor there. An' for once they're right.

Kentucky Moon

Poor Lizzie Hammerhandle
Does everything wrong,
She put the flowers in moonshine
And they burst into song.

The radio has got to the point o' where we can't look at a rainbow without wondering what it's advertising.

We can't decide which is the curse o' drink, the price or the quality.